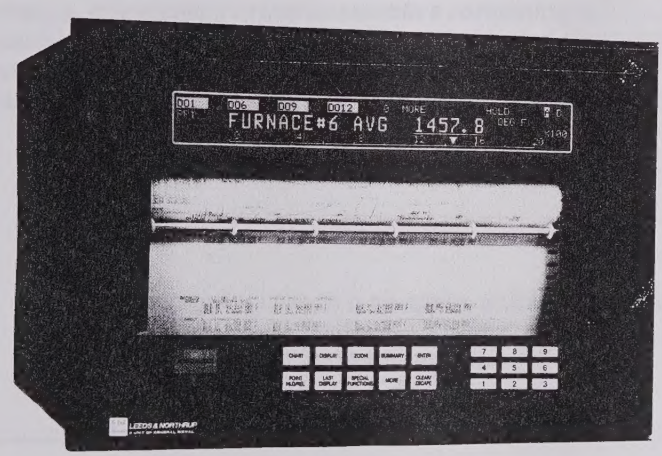
SPEEDOMAX® 25000 RECORDER

OPERATOR'S MANUAL 277800 Rev. E1



LEEDS & NORTHRUP
A UNIT OF GENERAL SIGNAL

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The purpose of this manual is to provide complete and accurate information to meet your operating and/or service requirements for L&N equipment. Your comments and suggestions are welcome.

Leeds & Northrup
Sumneytown Pike
North Wales, PA 19454
(800)553-3378
Attention: Manager, Engineering Services, MD-256

CAUTION

This equipment contains devices that can be damaged by electrostatic discharge. It is imperative that assemblies containing static-sensitive devices be carried in conductive plastic bags. Grounded work stations and wrist straps must be used when adjusting or performing any work on such assemblies. If soldering irons are used, they must also be grounded.

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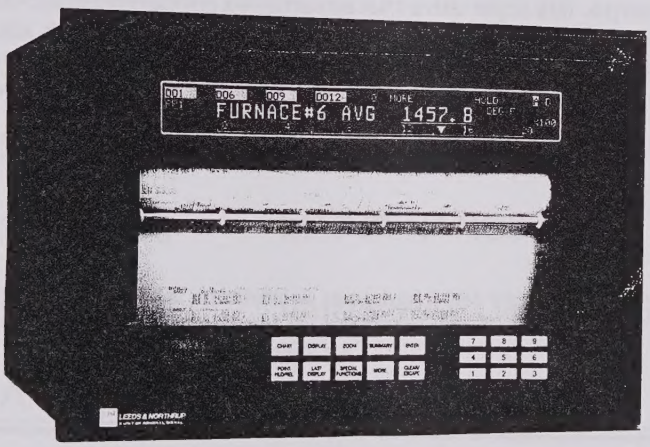

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SPEEDOMAX 25000 OPERATOR'S MANUAL

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DESCRIPTION AND FEATURES

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1. Description & Features

DESCRIPTION

The Speedomax 25000 is a multipoint, multiple function recorder which can record, display and process up to 135 input/output data points either analog or discrete, in various combinations. The basic recorder has a capacity of 60 points in 4 card slots. The optional Expansion Unit provides an additional 5 card slots, which can contain up to 75 points (Fig. 1-2).

User programming capabilities include comprehensive mathematical and logic functions and capacity for up to 60 pseudo points and 50 constants in memory, in addition to the 135 inputs/outputs.

The SPEEDOMAX 25000 (Fig. 1-1) is designed for panel mounting. It utilizes a 9-wire, 4-color impact print mechanism and fanfold chart paper with preprinted scale and time lines. The chart is illuminated by an internal fluorescent lamp for improved visibility and has an automatic chart advance feature for convenient monitoring of the most recently printed trend data. Chart speeds are selectable from 1-200 cm/hr in 1cm/hr increments. Printing rate adapts automatically to chart speed. A HI/LO selector allows the operator to choose either of two pre-programmed speeds. The high speed mode can be programmed to activate on an alarm.

All analog data, including pseudo points, can be printed in trend format. All data can be printed in digital format. Up to 30 points can be trended simultaneously.

A high visibility, four line dot matrix gas plasma display features a double size enhanced character mode for easy view of individual point data from a distance. Operation of the display is independent of the printer and is fully under operator control from the front panel keyboard or from user programming.

Data can be divided into groups for convenient comparison on printouts. Several groups may be printed simultaneously (a maximum of 30 points altogether). Scales and colors can be individually assigned. A split scaling feature allows division of the chart into 2 or 3 sections with a different group and scale for each.

Printed notations in the margins of the chart report summary information, open inputs, time and date, alarms, discrete events and diagnostic messages. Trendlines are identified on the chart by number or alphanumeric description (tag).

For cases where multiple trendlines tend to obscure the chart record, a "zoom" feature allows the operator to expand a selected region of the chart to full scale for better viewing.

DATA HANDLING

Input signals from the process may be analog, discrete or pulse type. Thermocouple, RTD and pulse inputs are directly accepted, with no need for intervening signal conditioning. To accept the signals, the appropriate type of circuit card must be installed. See the Specifications section for descriptions of the cards available. Process signal leads are connected to terminals which connect directly to the cards.

The input (output) numbers depend on the card location. 15 inputs (outputs) are assigned to each card slot, whether they are used or not. The terminal board label will guide the user in wiring and input/output numbering. It should be noted that not all input (output) numbers will necessarily be used (there may be gaps in sequence because some cards have less than 15 points).

Input or output data can be printed or monitored on the display. Data may also be used in calculations and the calculated results handled in the same way as other data. Calculations may utilize special formulas, or any of several computational algorithms which are resident in the SPEEDOMAX 25000. Pre-packaged calculation formats include Signal, Average, Group Average, Totalization, Mass Flow and many others, which are described in the Operation and Configuration sections of this manual.

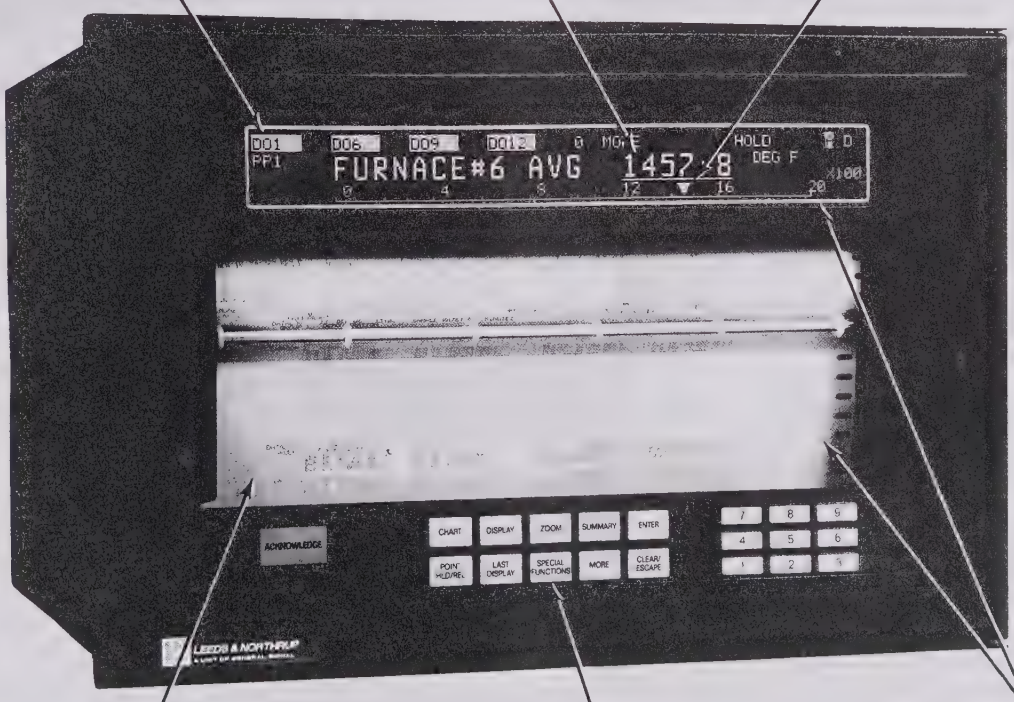
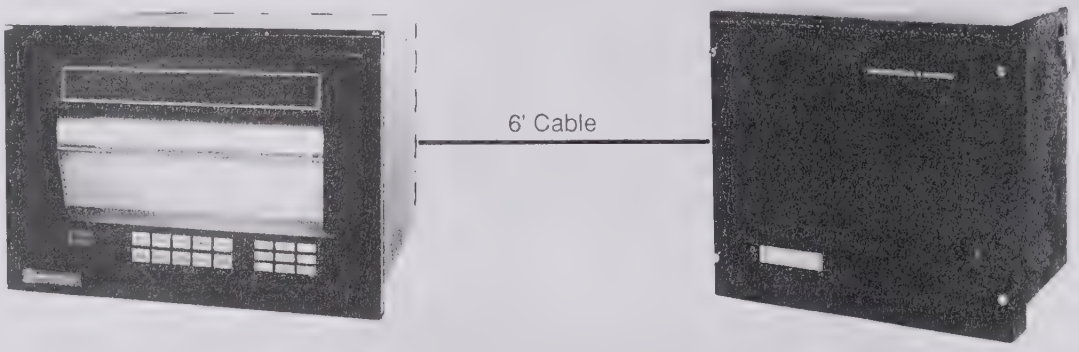


Figure 1-1
Description and Features

1. Description & Features

Speedomax 25000 with Expansion Unit



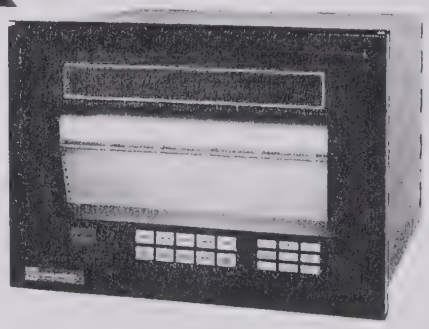
Speedomax 25000 Recorder

Expansion Unit
(Optional)

Available I/O Cards

4 Card Slots Accept Any Mix
of Input And Output Cards Shown

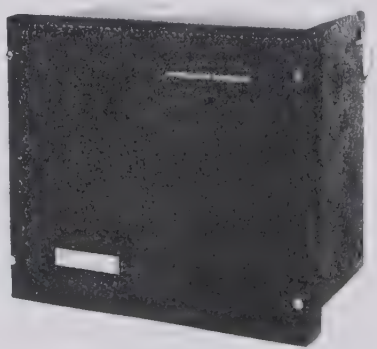
INPUTS
15 Analog Inputs
10 Analog Inputs
8 Analog Inputs
10 RTD Inputs
5 Pulse Inputs
15 Discrete DC Inputs
15 Discrete AC Inputs
7 Discrete Inputs &
8 Discrete Outputs
AC or DC



OUTPUTS
16 Voltage Outputs
10 Discrete AC Outputs
10 Discrete Dc Outputs
10 Relay Outputs

5 Card Slots Accept Any Mix
of Input And Output Cards Shown

INPUTS
15 Analog Inputs
10 Analog Inputs
8 Analog Inputs
10 RTD Inputs
5 Pulse Inputs
15 Discrete DC Inputs
15 Discrete AC Inputs
7 Discrete Inputs &
8 Discrete Outputs
AC or DC



OUTPUTS
10 Discrete AC Outputs
10 Discrete DC Outputs
10 Relay Outputs

Figure 1-2

ALARMS

From a configuration standpoint, the operator can consider an individual alarm as a sensor which can be attached to virtually any desired parameter. The parameter may be an input, an output, any data point or combination of data points, or a calculated value (pseudo point) or combination of calculated values. The "sensor" can be set to recognize changes in values, whether measured or calculated, and changes in state, including logic states. Because individual alarms can also be linked together in logical AND or OR relationships, alarms can be tailored with great flexibility to match complex interacting relationships within a process.

An alarm triggers a discrete output (DO). Alarm status can be monitored individually or in summary form. Alarms can be displayed and printed on occurrence and when cleared.

As selected by the user, alarms can be reported on the chart and on the display with descriptive information. Alarm information includes parameter I.D. and value, alarm limit, and reference I/O descriptions. Events, open inputs, and diagnostic messages can be similarly reported.

PROGRAMMING

The SPEEDOMAX 25000 is shipped fully configured and ready to operate with factory set values for all parameters and functions. This is referred to as the "default" configuration. If the user does not enter different values, the factory set items will apply, by "default". It is intended that this default configuration be modified by the user as needed to suit the application.

Programming is accomplished by means of a special hand held keyboard and the SPEEDOMAX 25000 display. An IBM PC, XT, or AT type keyboard may be substituted for the programmer's keyboard. No special cabling is required. (A circuit card jumper and DIP switch must be repositioned if an IBM PC or XT keyboard is used.) The SPEEDOMAX 25000 receptacle will accept the IBM keyboard plug directly.

Programming operations are fully menu-driven with screen prompts to guide each step. A "copy" function reduces the need for repetitive keyboard work during data entry. Configuration data is stored in battery-backed RAM.

SECURITY

A two-level optional security feature is provided.

For operation, operator access to certain functions can be restricted by requiring entry of a 4-character code at the operator's keyboard.

For programming, access to all programming activities may be restricted by requiring entry of a separate 4-character code. This code must be entered at the programmer's keyboard. Codes may be letters or numbers and are programmed by the user.

The use of these codes is optional. Access to either operation or programming will be unrestricted unless a code is deliberately programmed in advance.

1. Description & Features

DIAGNOSTICS

The SPEEDOMAX 25000 has built-in diagnostic capabilities. Self-diagnosis procedures are performed automatically at power up and continuously during operation. In program mode, other diagnostic routines are available for detailed problem diagnosis from the keyboard.

PROGRAM STORAGE UNIT

The Program Storage Unit (Fig. 1-3) is an accessory for the L&N SPEEDOMAX 25000 Recorder. Its function is to allow Recorder software configurations to be stored on a floppy disk.

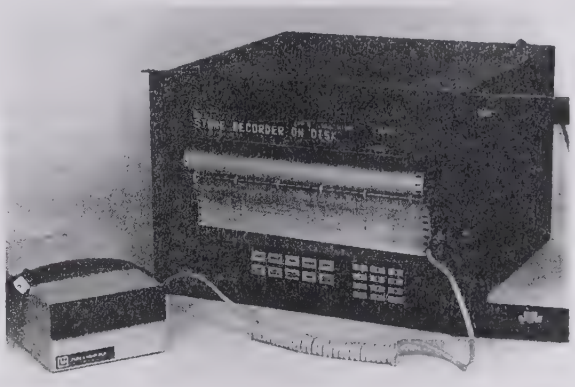


Figure 1-3
Program Storage Unit

Once the configuration has been created, it may be copied onto a floppy disk in the Program Storage Unit for storage. The SPEEDOMAX 25000 configuration may then be altered to serve some other function. At any later time, the configuration may be retrieved from the disk and loaded into the Recorder to restore the previous mode of operation. Using multiple disks, an unlimited number of Recorder configurations may be stored. A single disk has the capacity to store over 200 configurations.

The Program Storage Unit is operated from the SPEEDOMAX 25000 keyboard following menu-driven procedures with screen prompts, just as in normal Recorder operation. The Program Storage Unit also features a built-in self diagnostic capability. For more information, see Manual #277825.

NOTE

If the optional Program Storage Unit is used with the Recorder, operator access can be restricted by requiring entry of a 4-character code at the operator's keyboard. For more information, see Manual #277825.

SECTION 2
SPECIFICATIONS

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2. Specifications

GENERAL

Recorder

Performance: Meets or exceeds performance requirements of ANSI C39.4.

Safety: Meets or exceeds requirements of ANSI C39.5.

Maximum Number of Cards: 4.

Chart: Preprinted pack, 35 cm x 8 cm fanfold x 25 meters long.

Chart Speeds: All chart speeds are metric. Selectable from 1-200 cm/hr in 1 cm/hr increments.

Display:
Type: Gas plasma dot matrix.
Resolution: 32 pixels/inch.
Color: Orange.
Size: 1 1/4" x 12" (40 x 384 pixels).

Keyboard:
Operator's: Membrane switch panel.
Programmer's: Custom hand-held membrane switch panel or IBM® AT, XT, or PC type.

Update (Scan) Rate: All inputs, pseudo points, etc., are scanned in 1 second for alarms, etc.

Non-Volatile Memory: Battery backed RAM.
Battery type: Lithium.
Battery life: 2 years.

Environmental:
Temperature: Operation, –5 to 50°C.
Storage: -30 to +70° C.
Humidity: 10-90% RH, non-condensing.

Power Requirements:
120 VAC (+10%, –15%) 50/60 Hz,
220/240 VAC (+10%, –15%) 50 Hz.
Consumption 100 VA. Must be ordered from factory as 50 Hz or 60 Hz and 120, 220 or 240 VAC. Field conversion is not possible.

Weight: 60 lbs. maximum.

Dimensions: 12.3" H x 17.9" W x 17.2" D (depth measured from front of panel).

Expansion Unit

Maximum Number of Cards: 5.

Environmental:
Temperature: Operation, –10 to +55°C.
Storage: –30 to +70°C.
Humidity: 10–90% RH, non-condensing.

Power Requirements:
120 VAC (+10%, –15%) 50/60 Hz,
220/240 VAC (+10%, –15%) 50 Hz.
40 VA average.

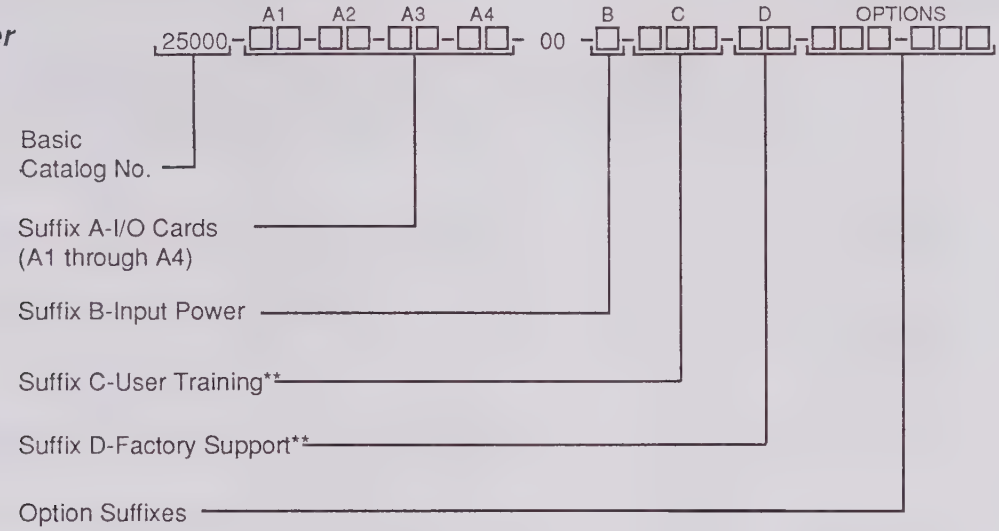
Weight: 45 lbs. maximum.

Dimensions: 17.5" H x 19.0" W x 14.8" D.

2. Specifications

CATALOG NUMBERING SYSTEM

Recorder



Basic Catalog Number

25000 Recorder
25010 Recorder with Foreign Languages

Suffix A – I/O Cards (A1 through A4)

(Any card may go in any position except Analog Retransmission Outputs (Suffixes 32 to 38), which must be in A1 and A2).

00 None
09 15 Point High/Low Level – High Noise Immunity
10 15 Point High/Low Level TC/EMF Inputs
11 10 Point High/Low Level TC/EMF Inputs
12 8 Hi Level EMF Inputs
13 10 RTD Inputs
14 5 Pulse Inputs
15 15 Discrete AC Inputs
16 7 Discrete AC Inputs & 8 Discrete AC Outputs
17 10 Discrete AC Outputs
18 10 Relay Outputs
19 15 Discrete DC Inputs
20 7 Discrete DC Inputs & 8 Discrete DC Outputs (5-60 VDC)
21 10 Discrete DC Outputs
22 10 Discrete DC Outputs High Voltage
23 15 Discrete 240 VAC Inputs
24 7 Discrete DC Inputs & 8 Discrete DC Outputs (5-200 VDC)

Analog Retransmission Outputs – 2 cards maximum, must be in A1 or A2:

32 2 Outputs on one card
34 4 Outputs on one card
36 6 Outputs on one card
38 8 Outputs on one card
41 Serial Communications – 1 Port
42 Serial Communications – 2 Port
52 Mounted 2-Wire Terminal Board for Future Expansion
53 Mounted 3-Wire Terminal Board for Future Expansion

Suffix B – Input Power

5 120 Volts, 50 Hz
6 120 Volts, 60 Hz
7 220 Volts, 50 Hz
8 240 Volts, 50 Hz

Option Suffixes

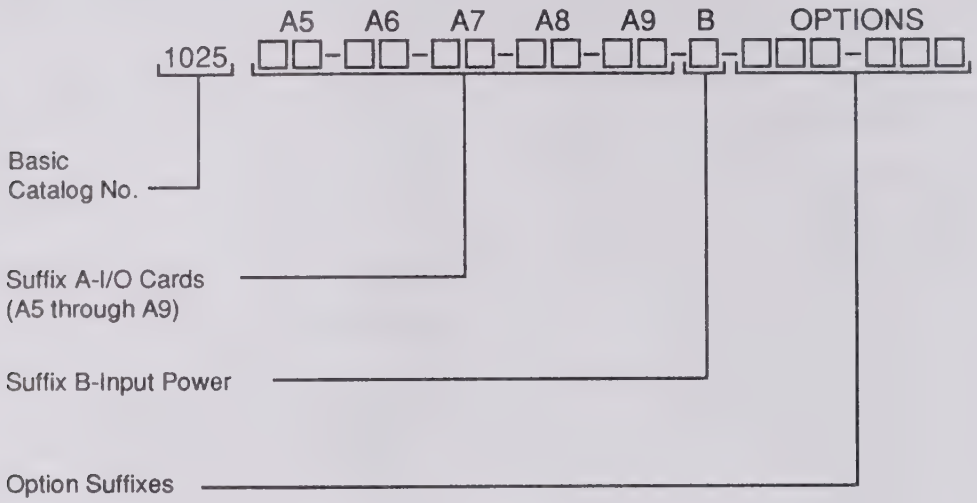
048 Non Glare Glass
056 Service Data Package
206 Linen Tag
208 Stainless Steel Tag
460 Omit IBM Style Programming Keyboard*
461 Hand Held Keyboard in place of IBM PC AT type
522 Line Cord (120V, 60 Hz only)

* *Recorder is designed to interface with industry standard IBM style keyboard. However, L&N cannot be responsible for Recorder operation using a sub-standard keyboard.*

** *Contact Leeds & Northrup field office for details of training and factory support.*

2. Specifications

Expansion Unit



Suffix A – I/O Cards (A5 through A9)
(Any card may go in any position).

00	None
09	15 Point High/Low Level – High Noise Immunity
10	15 point High/Low Level TC/EMF Inputs
11	10 Point High/Low Level TC/EMF Inputs
12	8 Hi Level EMF Inputs
13	10 RTD Inputs
14	5 Pulse Inputs
15	15 Discrete 120 VAC/DC Inputs
16	7 Discrete AC Inputs & 8 Discrete AC Outputs
17	10 Discrete AC Outputs
18	10 Relay Outputs
19	15 Discrete DC Inputs
20	7 Discrete DC Inputs & 8 Discrete DC Outputs (5-60 VDC)
21	10 Discrete DC Outputs 5 to 60V
22	10 Discrete DC Outputs 5 to 200V
23	15 Discrete 240 VAC/DC Inputs
24	7 discrete DC Inputs & 8 Discrete DC Outputs (5-200 VDC)

Suffix B – Input Power

5	120 Volts, 50 Hz
6	120 Volts, 60 Hz
7	220 Volts, 50 Hz
8	240 Volts, 50 Hz

Option Suffixes

017	Wall Mounting Option
206	Linen Tag
208	Stainless Steel Tag
522	Line Cord (120V, 60 Hz only)

Accessories

074477	Current Shunt Resistor (250 ohms)
078593	Hand Held Keyboard
078599	IBM Type Keyboard

2. Specifications

I/O CARDS

Analog Input Cards

Input Types: Thermocouple, mV, V, mA (via shunt) and radiation sensors.

Current Inputs: Use terminal board mounted shunt resistors (ordered and supplied separately).

Range Supression: Limits not imposed.

Input Impedance: 20 megohms.

Maximum Source Resistance: 15K ohm (8 point card is 1K ohm).

Point to Point Isolation: 200 Volts peak.

Common Mode Rejection: 120 dB (100 ohm source, 100V max.), 50 or 60 Hz.

Normal Mode Rejection: 60 dB (50 or 60 Hz, 100% span max.)

Input Switching: Low thermal reed relay, 500 million operations rating.

Open Input Check: Selectable on per point basis. Open inputs are indicated in the right hand chart margin. An open input is posted when thermocouple and lead wire resistance is 1K ohm or higher.

The open input is checked on ranges up to 250 mV.

Minimum Span: 10 mV.

2. Specifications

Ranges/Accuracy:

	Range	Card Type 10/15 Point	Card Type 8 Point	Accuracy* (25± 2°C for 1 Yr.)	Display Resolution
V	Selectable Range between -2.000V and +5.0000V. Minimum Span, 10mV	X		±0.1% of reading. For Zero Accuracy, see Zero Accuracy table below.	5 digits, including sign & decimal point.
V	Hi level, selectable (between -2.000V and +10.000V), Minimum Span 4.0V.		X	±0.1% of reading + 4mV	5 digits, including sign & decimal point.
TC	E -450 to 2200°F -276 to 1200°C J -350 to 2190°F -212 to 1195°C K -450 to 2800°F -267 to 1535°C T -450 to 760°F -267 to 400°C N -8 to 2372°F 0 to 1300°C W5-W26 0 to 3980°F -18 to 2194°C Plat II -100 to 2500°F -74 to 1372°C B 300 to 4540°F 149 to 2504°C R -50 to 3210°F -45 to 1765°C S -50 to 3640°F -45 to 2004°C	X		±0.1% of reading. For Zero Accuracy, see table below.	0.1° for ranges below 999.9. 1° for ranges above 999.9
	Radiation Ranges	X		See Rayotube and Spectray Table on the following page.	

**can be calibrated to ±0.01% of reading (or display resolution)*

Zero Accuracy:

High End of Range (in millivolts)	Zero Accuracy (in microvolts)
0 –10	±15
10 – 24.999	±20
25 – 49.999	±30
50 – 99.999	±60
100 – 249.99	±100
250 – 499.99	±200
500 – 999.99	±500
1000 – 2499.9	±1000
2500 – 4999.9	±2000

Reference Junction Error: 0.3°C (0.5°F).

Conformity Error: 0.3° C (0.5° F).

Source Effect on Accuracy: 0.3 microvolts/100 ohms.

Temperature Stability: 1.5 microvolts/°C.

NOTE: Some of the listed thermocouple range limits go beyond the IPTS 68 tables. This was done for specific customer applications and does not affect accuracy of the ranges within the IPTS limits. Beyond the published limits, L&N uses extrapolated values.

2. Specifications

Rayotube and Spectray Ranges

RAYOTUBE RANGES

1. 18890 **~1 – 24 MV**

18890 – 3302	750 – 1600° F	399 – 871° C
18890 – 0073	800 – 1800° F	427 – 982° C
18890 – 0074	1100 – 2300° F	594 – 1260° C
18890 – 0035	1200 – 2600° F	649 – 1426° C
18890 – 0412	1375 – 3000° F	747 – 1648° C
18890 – 0075	1500 – 3300° F	816 – 1815° C
18890 – 1729	1650 – 3600° F	899 – 1982° C
18890 – 0643	1850 – 4000° F	1010 – 2204° C
18890 – 0216	2110 – 4600° F	1155 – 2537° C
18890 – 5423	2210 – 5000° F	1210 – 2760° C
18890 – 0163	200 – 1000° F	94 – 537° C

2. 18894 / 18899 **~0 – 10 mV**

18899 – 8814	340 – 1800° F	172 – 982° C
18894 – 9014	752 – 2552° F	400 – 1400° C
18894 – 0579	752 – 2552° F	401 – 1400° C

3. Spectray **~0 – 125 mV** **(18885 / 18886)**

18885	1832 – 3452° F	1000 – 1900° C
18886	1832 – 3452° F	1001 – 1900° C
18885 – 1	1292 – 2912° F	700 – 1600° C
18885 – 2	806 – 1400° F	430 – 760° C
18886 – 1	1292 – 2912° F	701 – 1600° C

4. Fiberay **1 – 5 V**

070701	1472 – 2372° F	800 – 1300° C
070705	2192 – 2912° F	1200 – 1600° C
070703	1832 – 2732° F	1000 – 1500° C

5. 18874 / 18875 **1 – 5 V**

18874 – 0578	752 – 2552° F	400 – 1400° C
18875 – 0579	752 – 2552° F	401 – 1400° C

2. Specifications

RTD Input Card

Type: 10 point, 3 lead (all leads switched).

Input Types: 10 ohm copper, 100 ohm platinum (alpha =.00385 ohm/ohm/°C), 1000 ohm platinum (alpha =.00375 ohm/ohm/°C).

Input Type	Range	Accuracy
Cu, 10 ohm	–50° to +150° C	±0.15%* + .30° C
Pt, 100 ohm	–180° to +850° C	±0.15%* + .30° C
Pt, 1000 ohm	–184° to +537° C	±0.15%* + .30° C

Input Type	Resolution
Cu, 10 ohm	0.1°, thru
Pt, 100 ohm	999.9, 1°
Pt, 1000 ohm	above 999.9

Conformity Error: 0.3° C (0.5° F).

Temperature Stability: 1.5 microvolts/° C.

Excitation Current: 1 mA.

Maximum Compensation for Lead Resistance: 5 ohms.

Minimum Resistance Span: 8 ohms.

Point to Point Isolation: 200 Volts peak.

Input Switching: Low thermal reed relay, 500 million operations rating.

Common Mode Rejection: 120 dB (100 ohm source, 100V max.), 50 or 60 Hz.

Normal Mode Rejection: 60 dB (50 or 60 Hz, 100% span maximum)

** percent of reading*

Pulse Input Card

No. of Inputs: 5.

Frequency Range: 10 Hz to 10 KHz pulse rate.

Input Level:

1) 5 volt - sine to square wave
   "0" level < 1.0V
   "1" level 3.5 to 6.5V
   Current 1.6 mA source
2) 24 volt - sine to square wave
   "0" level < 1.0V
   "1" level 5 to 30V
3) Open collector-customer supplied voltage and pullup resistor

Duty Cycle: 40 to 60%.

Input Type: DC coupled floating isolated input.

Accuracy: 1 pulse per update period.

Minimum Pulse Width: 0.1 ms.

Input Isolation: Point to point, point to ground, optical.

2. Specifications

Discrete Inputs/Outputs

All SSR (Solid-State Relay) discrete input/output cards use single plug-in modules (Potter & Brumfield, Opto-22, or equivalent) for each point. Isolation of all solid-state relay modules is 4 KVRMS, input to output. All SSR output modules are individually fused.

15 point AC Input
Voltage Range: 90 to 140 VAC
Input Current: 12mA maximum
Turn On/Off Time: 20 ms

15 point DC Input
Voltage Range: 10 to 32 VDC
Input Current: 35 mA maximum
Turn On/Off Time: 5 ms

10 point AC Output
Voltage Range: 24 to 280 VAC
Current Rating: 1 A
Surge Current for 1 Cycle (16 ms): 15A.
Minimum Current: 20 mA
Switching: Zero-crossing

10 point DC Output
Voltage Range: 5 to 60 VDC
Current Rating: 1 A
Turn-On Time: 500 microseconds
Turn-Off Time: 750 microseconds

10 point Relay Output
Type: SPDT Form C relays, plug-in
Contact Rating: 1A Maximum (3A for selected relays with a maximum of 70A for any Recorder or Expansion Unit) at 120/240 VAC

7 point AC Input/8point AC Output
AC Inputs: 90 to 140 VAC
AC Outputs: 24 to 280 VAC @ 1 A.
Surge Current for 1 cycle (16 ms): 15A.

7 point DC Input/8 point DC Output
DC Inputs: 10 to 32 VDC
DC Outputs: 5 to 60 VDC @ 1 A

10 point DC Output
Voltage Range: 5 to 200 VDC
Current Rating: 1 A
Turn-On Time: 500 microseconds
Turn-Off Time: 750 microseconds

7 point DC Input/8 point DC Output
DC Inputs: 10 to 30 VDC
DC Outputs: 5 to 200 VDC

Analog Outputs

Output Base Card Capacity: 2 to 8 retransmission outputs (4 dual output cards).

Function: Retransmission of analog inputs, calculations, function block outputs.

Type: Dual Voltage Output.

Isolation: Dual output card to dual output card, 480 VRMS.

Dual Voltage Output Card:

Outputs/Card: 2 (independent).

Isolation: Input to output, 240 VRMS.

Range: 0 to 5V, 0 to 10V at 10 mA maximum

Resolution: 0.025%.

SECTION 3
INSTALLATION

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3. Installation

INSTALLATION - GENERAL

UNPACKING

Examine the shipping container carefully before opening it. If there are visible signs of damage, do not open the container. Notify the carrier and Leeds & Northrup immediately.

If there is no visible damage, open the container and compare the contents with the packing list. Notify the carrier and Leeds & Northrup immediately if there is equipment damage or shortage.

To obtain proper credit and to avoid delays, do not return goods without contacting Leeds & Northrup in advance.

Carefully remove the Recorder from its packing case and then remove any shipping ties or packing material. Follow the instructions on any attached tags or labels and then remove such tags or labels. Open the Recorder door and remove any internal packing materials or braces.

During shipment the Recorder mainframe is securely fastened in place in the Recorder case by a shipping screw. The screw must be removed before the Recorder can be installed.

Locate the screw at the bottom right side of the case (Fig. 3-1). Remove and discard the screw.

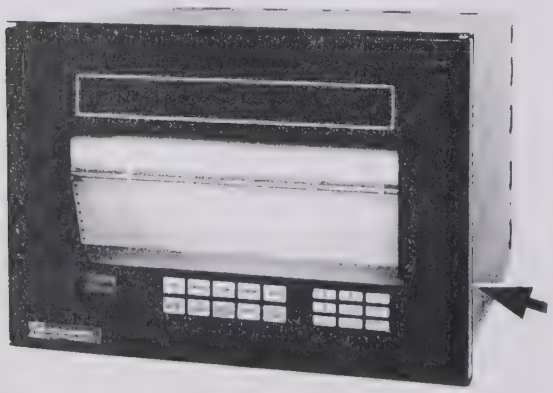

Figure 3-1
Shipping Screw

Remove the Recorder door by depressing the upper hinge pin. Remove two screws on the side securing the shipping bracket. Open the mainframe (see Figure 3-7). Remove the final screw and remove the bracket.

Remove the six ties which secure the printhead, paper drive and the detour shaft assembly. Replace the door and discard the shipping bracket and screws.

INSPECTION

All SPEEDOMAX 25000 Recorders are calibrated and tested at the factory before shipment. Functional testing before installation is unnecessary and is not recommended.

Examine the shipping documents. The Recorder is identified by a serial number and a catalog number which identifies the options which are included with each unit of equipment. The numbers are also located on the unit nameplate which is located inside the Recorder on the lower right hand side of the case.

See the Specifications section for an explanation how to interpret the catalog number. Identify the options which are specified. Some options may be packaged and shipped separately. Be sure the correct options have been delivered and that all the specifications agree with what was ordered.

Please provide the serial number in any communications with Leeds & Northrup about this product.

STORAGE AND SHIPMENT

For prolonged storage or for shipment, the Recorder should be kept in its shipping container. Do not remove shipping clamps or covers. Store in a suitable environment only (see Specifications).

LOCATION

Speedomax 25000 Recorders are designed for vertical panel mounting in protected (indoor) locations where the ambient temperature is within the range of –5 to +50°C (+16 to +122°F).

3. Installation

INSTALLATION – MECHANICAL

Figure 3-3 illustrates how the Recorder is attached to the panel. Provide the panel cutout as shown. Note that the panel may be from 1/8" to 7/8" (3.17 to 9.53 mm) thick.

Note that it is not necessary to drill holes in the panel. The Recorder is fastened to the panel by clamping the edges of the cutout between the case flange and three clamping bars which are tightened against the rear of the panel.

Proceed as follows:

1. Remove the door by depressing the upper hinge pin.

2. Insert the Recorder into the panel cutout and hold it in place. This will require one person on each side of the panel.

3. From the rear of the panel, place each of the three clamping bars (top and both sides) on the case and loosely fasten the 1/4-20 screws towards the rear of the unit (Figure 3-2).

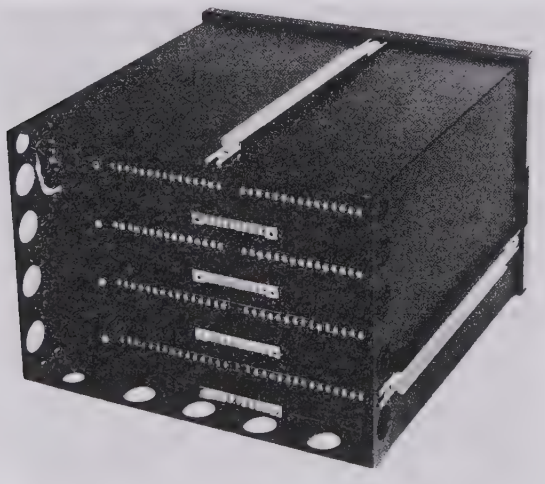

Figure 3-2
Clamping Bars

4. Open the mainframe from the front of the panel (see Figure 3-7). Insert #10-32 screws through the three slots on the inside wall of the case to engage the clamps on the outside. Turn the screws all the way in until they are snug, but do not tighten them.

5. Close the mainframe and hold the Recorder firmly against the panel. Push or tap the top clamp against the rear of the panel and tighten the screw. Tighten the side clamps in the same way.

6. Reopen the mainframe from the front and tighten the front clamp screws.

7. Reattach the door to complete the mechanical installation.

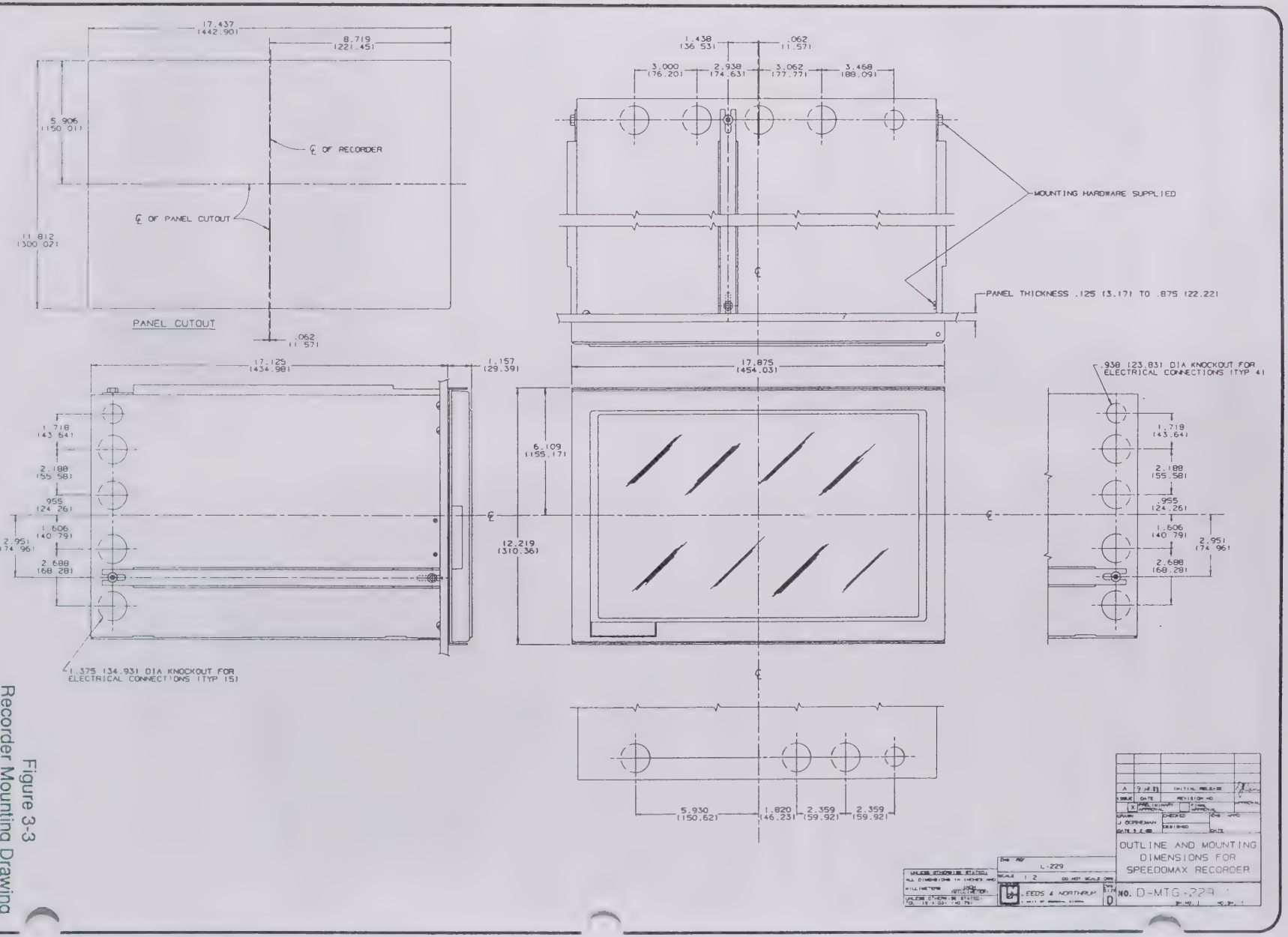

Figure 3-3
Recorder Mounting Drawing

3. Installation

INSTALLATION - ELECTRICAL

CAUTION

All wiring must be done by qualified technicians and must conform to national or local electrical codes.

GENERAL WIRING RECOMMENDATIONS

In general, stranded copper wire should be used for non-thermocouple electrical connections. Keep in mind that the maximum load resistance for many process instruments includes the interconnecting wire. Unless otherwise specified, input signal wiring does not have to be shielded, as long as it is not run with alternating current wiring which supplies switching circuits, such as motor starting loads, or is near strong electromagnetic fields.

Twisted signal pairs and shielded cable will improve noise immunity if wire routing is suspect. Terminals for shield connections are provided.

Observe all local electrical codes when making power connections.

All electrical connections are made at the terminal strips on the rear of the Recorder (Fig. 3-4). For access to the terminals, remove two screws and the rear access cover (Fig. 3-5).

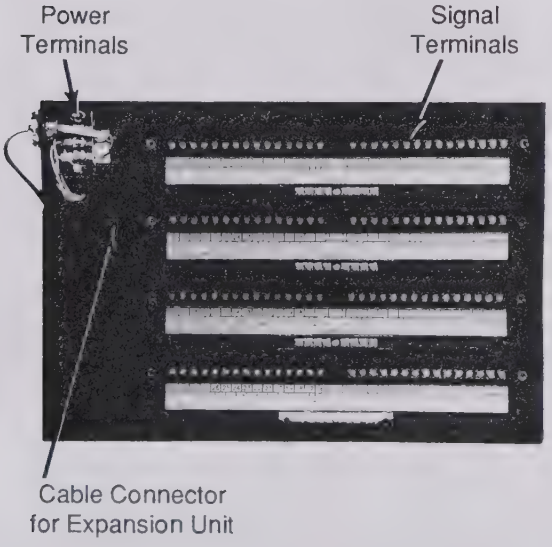

Figure 3-4 Terminal Strips

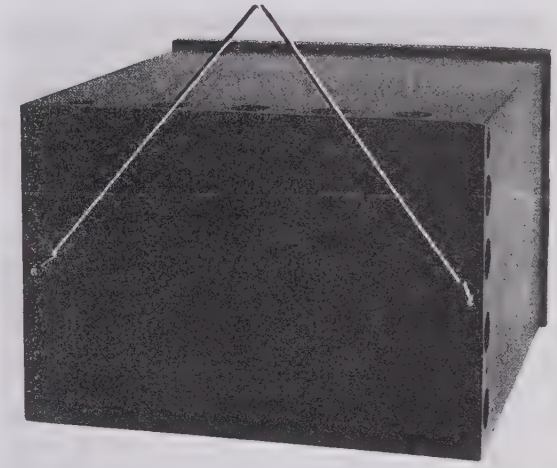

Figure 3-5
Remove Screws and Cover

NOTE

All Recorders and Expansion Units are shipped from the factory with circuit cards installed and labeled. Be sure any shipping pads or braces are removed. Do not apply any electrical inputs until connections are completed.

POWER CONNECTIONS

The proper voltage and frequency of the power required are shown on the Recorder nameplate.

The power supply voltage must be within the limits stated in the Specifications. Connect the AC voltage to the terminal board on the rear of the case (Fig. 3-4). Connect the hot side of the line to terminal L1 and the grounded side of the line to terminal L2.

If the L2 side of the line cannot be grounded, add an isolating transformer electrically between the power supply and the Recorder and ground the L2 terminal.

NOTE

The ground terminal must be connected to a reliable earth ground for proper operation and in order to comply with OSHA and other safety codes.

3. Installation

SWITCH AND FUSE

A power ON/OFF switch is located on the lower right hand side of the Recorder case (Fig. 3-6). A 1.6 ampere slow-blow fuse is also included in the hot side of the line. It is located on the power switch assembly.

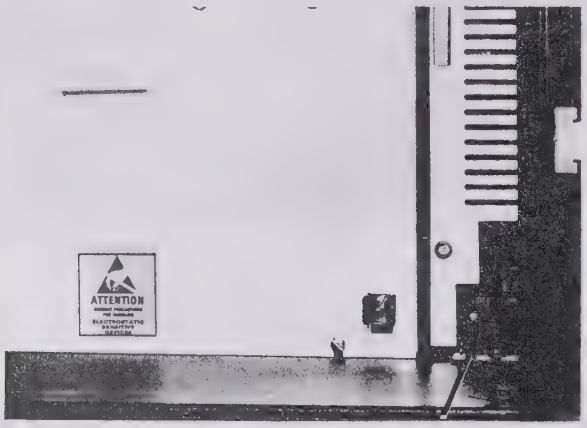

Figure 3-6
Power Switch

PROGRAMMING KEYBOARD

The Recorder utilizes the industry standard IBM PC AT style keyboard or a specially designed SPEEDOMAX 25000 hand-held keyboard for programming. An IBM PC or XT keyboard may also be used. The standard cable connector provided with any of these keyboards will plug directly into the receptacle on the front of the Recorder.

The SPEEDOMAX 25000 hand-held keyboard and the AT keyboard are completely interchangeable. However, if a PC or XT keyboard is to be used, a jumper and DIP switch adjustment must be made on the SPEEDOMAX 25000 CPU card.

IMPORTANT

A proper ground strap (L&N part number 035968 or equivalent) must be used whenever contact will be made with any electronic assemblies or components.

NOTE

If the adjustment is made for use of the PC or XT keyboard, the SPEEDOMAX 25000 hand-held keyboard and the AT keyboard will not function.

To make the adjustment for using a PC or XT keyboard, open the Recorder door, release the latch (Fig 3-7) and swing out the mainframe assembly to expose the CPU card (Fig. 3-8).

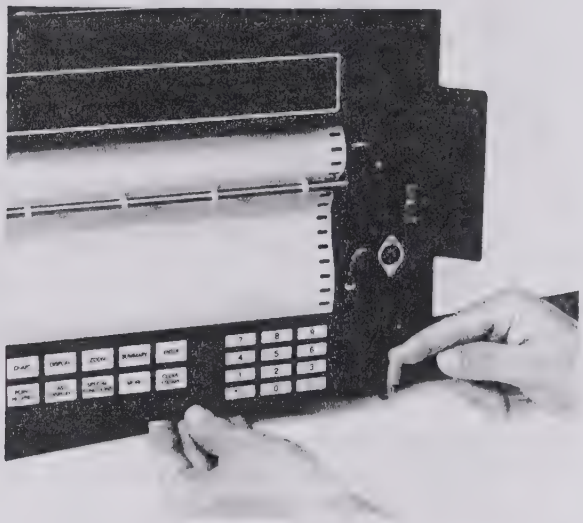

Figure 3-7
Recorder Mainframe Latch

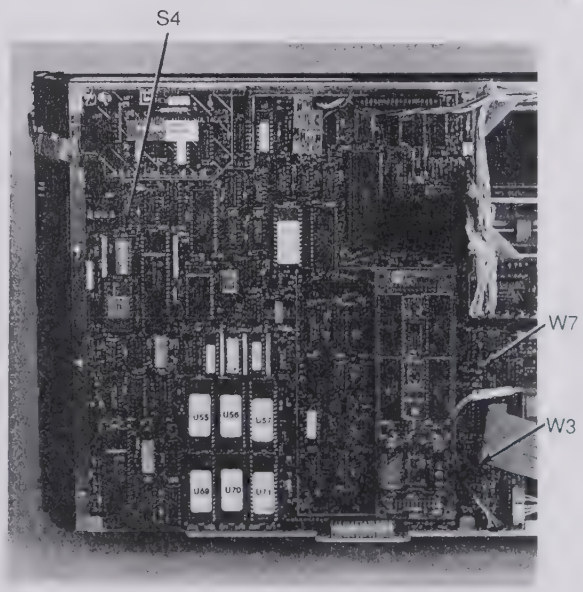

Figure 3-8
CPU Card DIP Switch and Jumpers

Set position 2 on DIP switch S4 to ON. Move jumpers W3 to the 2-3 position and W7 to the 2-3 position (Fig. 3-8). The IBM PC or XT keyboard will now function for programming. (The SPEEDOMAX hand-held keyboard and the IBM AT keyboard will not function.)

3. Installation

SIGNAL INPUT AND OUTPUT WIRING

Terminal configurations are factory-assigned according to the circuit cards installed in each individual Recorder. Customer I/O terminals are illustrated in Figures 3-10 and 3-11. Terminal labels are supplied with each unit. They are located beneath the terminals (Fig. 3-9).

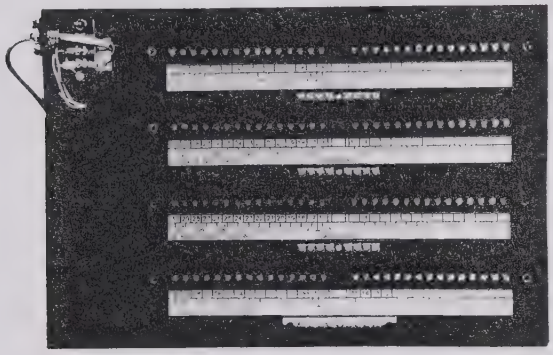

Figure 3-9
Terminal Labels

It is of utmost importance to carefully document all input and output connections. Because this information is used in programming all the functions of the Speedomax 25000, a careful list of terminal assignments should be made and double checked for accuracy.

A suggested terminal assignment list form is included in this section. Copy the numbers on the terminal labels onto this form. Whether copies of this form are used, or some other form, it is essential that the programmer be provided with an accurate and clearly labeled list of connections after installation is completed.

It will be well worth the effort to record all terminal assignments accurately. If an input or output is connected to a different terminal than the one the programmer enters into the system, the results could be costly and time consuming to find and correct.

Analog Input Signal Connections

Analog inputs must be connected to the proper type of analog input circuit card. The card converts the incoming analog signal to digital signals. The following types of analog input circuit cards are available:

15 point, Low Level TC EMF
10 point, Low Level TC EMF
8 point, High Level EMF
10 point, RTD
5 point, Pulse

See the Specifications section for input specifications for circuit cards.

Terminal designations for analog inputs are labeled at the factory (Fig. 3-11). Refer to those labels for information on where various points are to be wired and in what polarity.

All commonly used voltage and current signal inputs are accepted. Connect current and voltage inputs to the appropriately labeled terminals.

When required, current shunts are mounted on these terminals. Use Part No. 074477 for 0-20 mA input conversion to 0-5V.

NOTE

*For current inputs, shunt resistors are **not** provided.*

The SPEEDOMAX 25000 will accept direct inputs from thermocouples and resistance temperature detectors (RTD). The proper circuit card must be installed for each type. See the Specifications section for details.

SPEEDOMAX 25000 TERMINAL DESIGNATIONS

NAME _____

TB SLOT NO: 1 2 3 4 5 6 7 8 9
Expansion Unit

CARD TYPE: AI AO DI DO DI/DO

TERMINAL NO.	DATA POINT		
	TYPE	NO.	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
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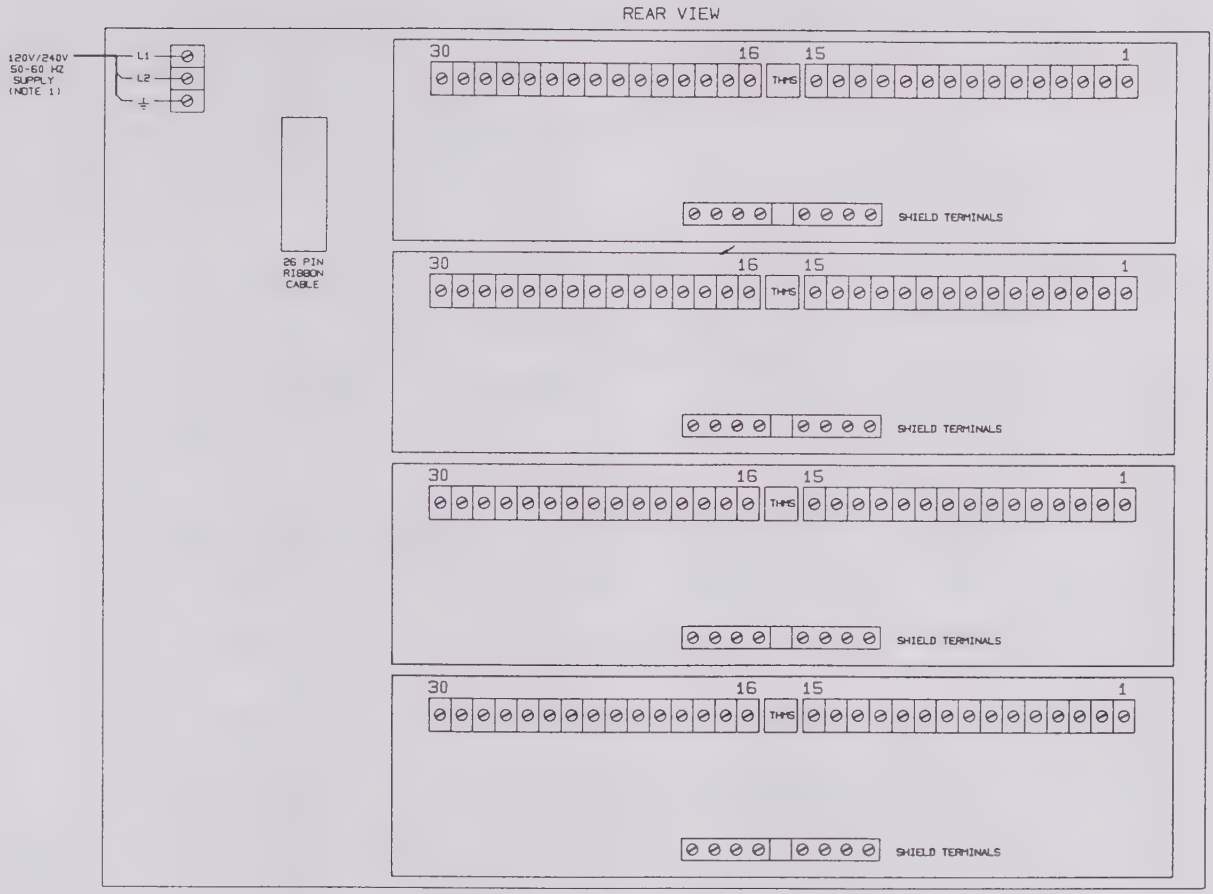
3. Installation



NOTES:

1. For 120V, L2 side of line should be grounded.
   For 220/240V, ground should exist between L1 & L2.
   If line supply cannot be grounded, add isolating transformer and ground L2 terminal.

2. Customer Wire:
   a. Single conductor (solid or stranded) #14 AWG or smaller.
   b. Double conductor, #18 AWG or smaller.

3. Screws must be tightened securely.
   Torque must not exceed 8.5 in lbs (9.792 CM-KG).

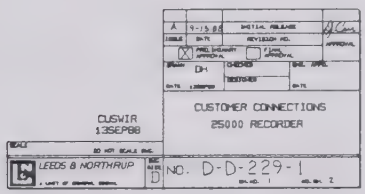


Figure 3-10
Customer Connections

3. Installation

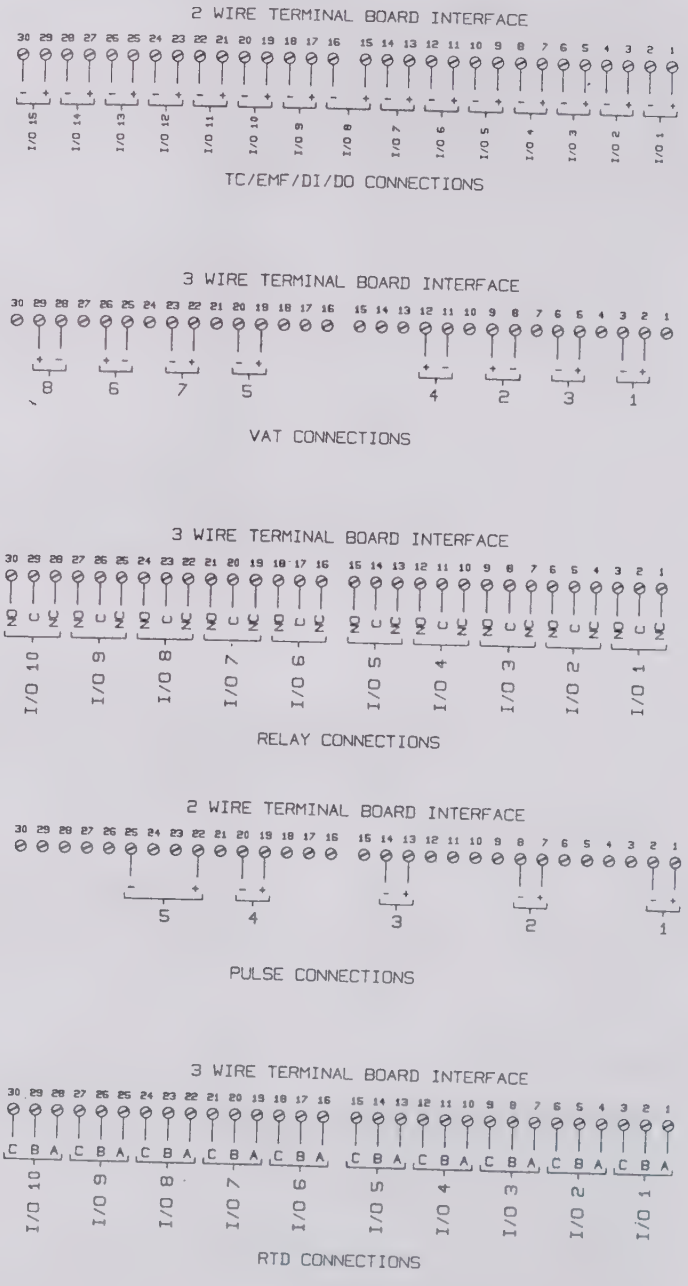


Figure 3-11
Customer Connections

3. Installation

Thermocouple Inputs

Thermocouple input leads should be connected to the (+) and (–) terminals for the analog input cards. The correct type of extension leadwire for the particular type of thermocouple must be used. See Table 3-1 for examples. Shields are connected to terminal boards below. Thermocouples may be grounded or ungrounded, since each point is isolated using reed relay switches.

THERMOCOUPLE EXTENSION WIRE TABLE					
THERMOCOUPLE COMBINATION	EXTERNAL TO INSTRUMENT				
	DUPLEX			SINGLE CONDUCTOR	
+ -	+	-	OVERALL	+	-
Copper Const. Type T	Copper B	Const. R	B	Copper B	Const. R-B
Iron Const. Type J	Iron W	Const. R	K	Iron W	Const. R-W
*Nickel-Chromium Const. Type E	Ni-Cr V	Const. R	N	Ni-Cr Y	Const. R-B
Nickel-Chromium Nickel-Aluminum Type K	Ni-Cr Y	Ni-Al R	Y	Ni-Cr Y	Ni-Al R-Y
Plat.-Rhod. Plat. Type S or R	Copper K	Alloy R	G	Copper K	Alloy R-K
Nicrosil Nisil Type N	Nicrosil O	Nisil R	O	Nicrosil O	Nisil R-O
Plat. 30% Rhenium (+) Plat. 6% Rhenium (-) Type B**	Copper A	Copper R	A	–	–
Tungsten 5% Rhenium (+) Tungsten 26% Rhenium (-) Type W5/W26***	Haskins Alloy 405 O (W-R)	Haskins Alloy 426 R (R)	O (W-R)	–	–

K - Black G - Green B - Blue O - Orange T - Tan A-Gray
W - White R - Red N - Brown Y - Yellow V - Violet

* *Thermocouple wire used as extension wire.*

** *Copper vs copper compensating leadwire, usable to 100° C (212° F) with maximum deviation of +0° C (+0° F) -3.7° C (-6° F), but with no significant deviation over 0 to 50° C (32 to 122° F). Matched proprietary alloy compensating is available for use over the range 0 to 200° C (32 to 392° F) with tolerances of ± 0.033 mV (± 3.7° C).*

*** *Lead wire color combinations are non-standard for W5/W26 thermocouple. Color codes shown are two which are currently being manufactured.*

TABLE 3-1
Thermocouple Extension Wire Table

RTD Inputs

RTD input leads should be connected to the proper terminals for the RTD input card. Note that an RTD has three leads (Fig. 3-12). The "A" and "B" leads must be equal in resistance. The "C" lead resistance is not critical. Each lead is relay-switched; therefore, no lead commoning is required.

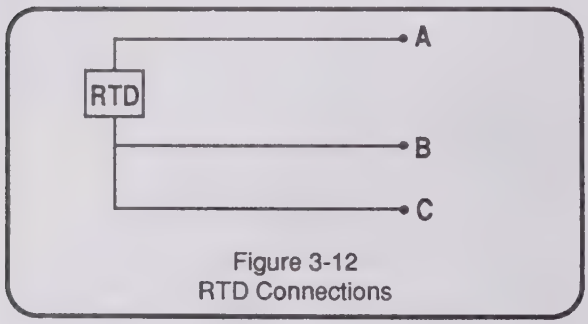


Figure 3-12
RTD Connections

Pulse Input Signal Connections

Pulse-type inputs from transducers such as turbines, magnetic flowmeters, or tachometers, must be connected to the terminals for a pulse input circuit card. See the Specifications section for input specifications for circuit cards. 5 or 24V signal level range is selectable on the circuit card.

Connect input signal leads to the designated terminals for the pulse input card. Inputs are optically isolated from instrument ground and from each other. For open collector inputs from pulse output devices, an external pullup resistor and power supply is required (supplied by user). See Figure 3-13.

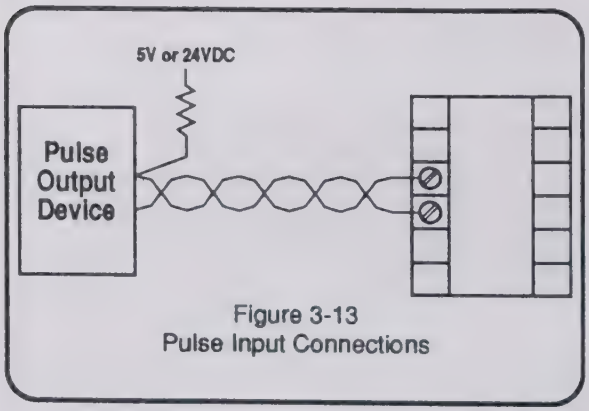


Figure 3-13
Pulse Input Connections

Discrete Input Signal Connections

NOTE
See the labels on the back of the Recorder to determine card types.

Discrete (switch-type) inputs must be connected to the terminals for a discrete input circuit card or to the proper terminals for a split discrete input/output circuit card. Be sure cards are of the proper type (AC or DC).

See the Specifications section for input specifications for circuit card modules.

Connect input switches and power commons as shown in Figure 3-14. Each discrete input circuit is a plug-in module providing optical isolation from instrument ground and from all other discrete inputs. For common power, all compatible input commons should be interconnected (see Fig. 3-14). Power to all modules is supplied by the user.

3. Installation

Discrete Output Signal Connections

Discrete output loads are connected to the terminals for discrete output circuit cards or the appropriate terminals for split discrete input/output cards as shown in Figure 3-14. The discrete output cards provide either a zero-voltage switched solid state triac switch and fuse or a Form C mechanical relay for each output. See the Specifications section for output signal specifications (switch characteristics) for output circuit card modules.

The relay output card provides both N.O. and N.C. contacts. This card can be configured for fail-safe (normally energized) operation by moving jumper W1 from the 1-2 position to the 2-3 position. When this mode is selected, all relay outputs are normally energized, and are de-energized when individually selected or when power fails.

The solid state relay switches are each optically isolated and also fully isolated from all other outputs. For common power, all module commons should be interconnected (see Fig. 3-14). Power to all modules is supplied by the user. Fuses are plug-in, and replacement requires removal of the I/O card.

NOTE

Effort has been made to suppress interference and voltage spikes from inductive loads on the discrete outputs (solenoids, motor starters, etc.). However, it is strongly recommended that the user suppress (with diodes, capacitors, etc., as appropriate) spikes from inductive loads at the load itself. Spikes entering the SPEEDOMAX 25000 on the customer wiring may, if strong enough, cause problems in the operation of the Recorder. See Figure 3-15 and the following recommendations.

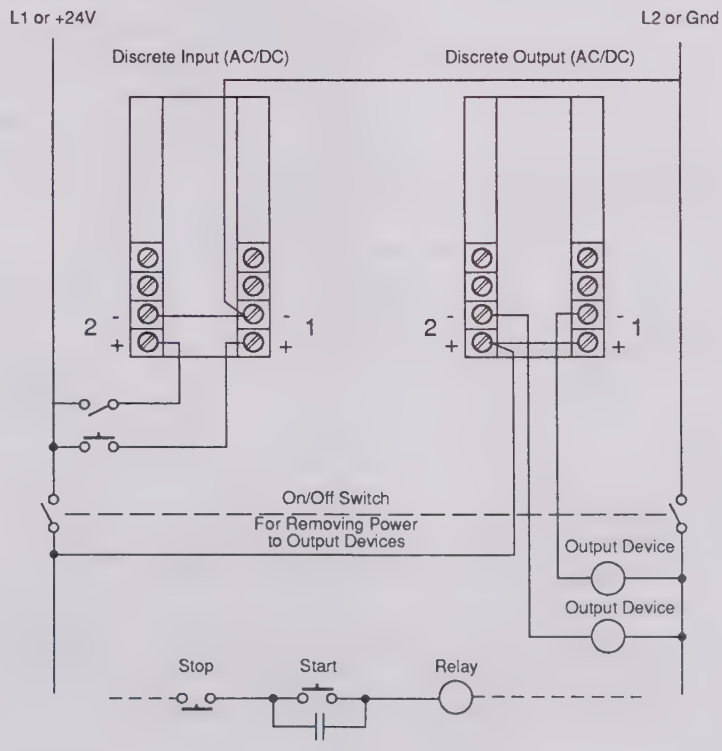


Figure 3-14
Discrete I/O Connections]
(Expansion Unit Terminal Board Shown)

3. Installation

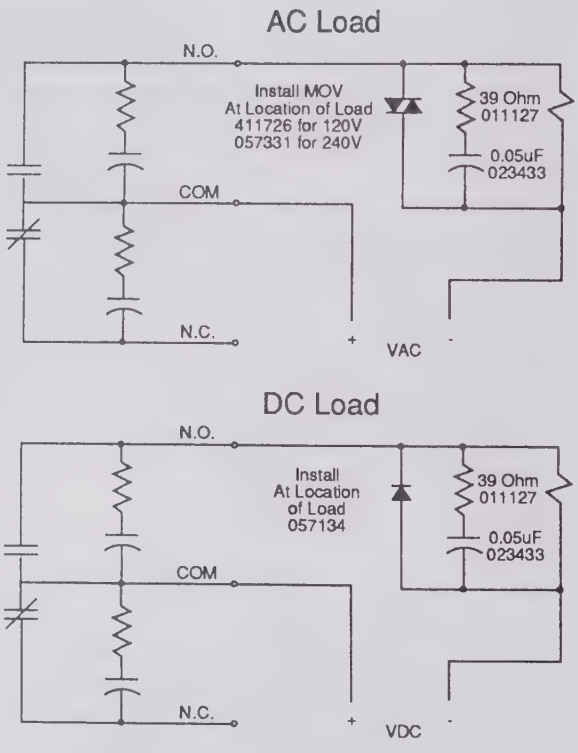


Figure 3-15
Noise Suppression for AC & DC Inductive Loads

It is recommended the AC or DC voltage supply be provided with an on-off switch in the circuit supplying power to the field output devices. This will enable removal of output power while the Recorder and input devices remain operational for troubleshooting purposes (Fig. 3-14). Optionally, a relay circuit may be substituted for the on-off switch. The relay will provide protection by removing power to the outputs whenever system power is lost. To restore power to the outputs after system power is regained, the start button must be depressed manually.

Analog Output Connections

Analog output leads must be connected to the appropriate terminals for a dual output circuit card. See the Specifications section for output signal specifications for output circuit cards.

See the terminal labels on the back of the Recorder for analog output card terminal designations.

0-5 VDC is provided as standard. See Table 3-2 f switch selection on the card for 0-10 VDC outpu When switching from one voltage output to another, recalibration is not necessary.

Output	Switch S1 or S2 Position Settings						S2 Only	
	1	2	3	4	5	6	7	8
0-5V	ON	ON	OFF	OFF	OFF	ON	OFF	ON
0-10V	OFF	ON	OFF	OFF	OFF	ON	OFF	ON

TABLE 3-2
Position Settings for
Switches S1 or S2 on the Circuit Card

DIP Switch Settings

DIP Switch S4 is located on CPU card (see Figure 3-8).

NOTE

With the exception of Position 2, DIP Switch S4 settings are provided here for reference only. Full instructions for the use of these settings are provided in Service Manual #277801.

DIP Switch S4 Settings		
Position	Factory Setting	Function
1	ON	Not Used
	OFF*	Not Used
2	ON	IBM PC or XT Keyboard
	OFF*	SPEEDOMAX or IBM AT Keyboard
3	ON	Not Used
	OFF*	Not Used
4	ON	Force to Calibration
	OFF*	Calibrate from Keyboard
5	ON**	50 Hz Power
	OFF**	60 Hz Power
6	ON	Reconfigure Database at Powerup
	OFF*	No Reconfigure Database at Powerup
7	ON	Cold Start
	OFF*	Warm Start
8	ON	Off-line Diagnostics
	OFF*	On-line Diagnostics

* Factory Setting
** Factory Set as Ordered

3. Installation – Expansion Unit

INSTALLATION – OPTIONAL EXPANSION UNIT

LOCATION

The Expansion Unit (Fig. 3-16) is housed in a NEMA 4 enclosure which may be mounted in a 19" rack, in a panel, or wall mounted, using the four brackets optionally provided.

Because the cable between the SPEEDOMAX 25000 and the Expansion Unit is 6 feet in length, location of the Expansion Unit on or behind the Recorder mounting panel is recommended.

Allow enough clearance to remove the front door and also to swing out the hinged card cage assembly from right to left (Fig. 3-17) for access when installed. Allow clearance also for routing of cable and for electrical conduit connections at the rear or sides of the housing.

MOUNTING

Install the Expansion Unit as shown in Figure 3-18 or 3-19. (For wall mounted units, install the brackets first, according to instructions provided with the bracket kit.)

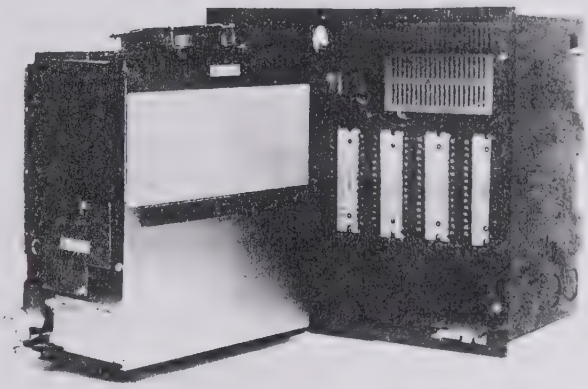
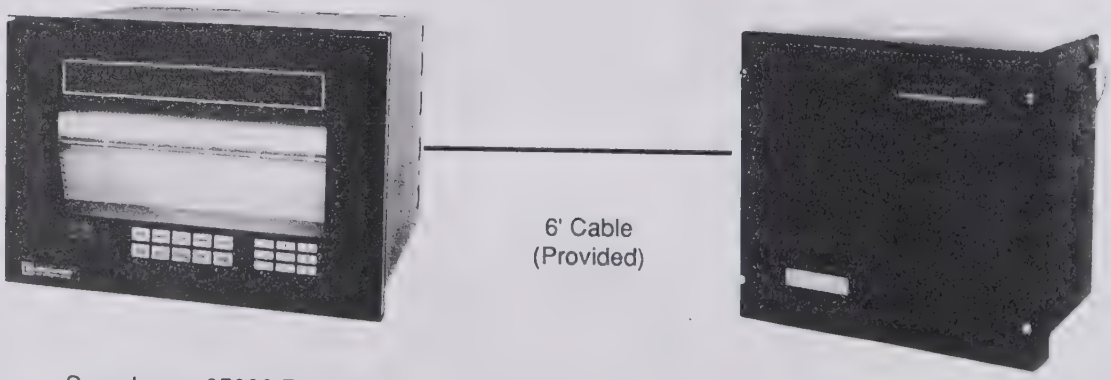


Figure 3-17
Hinged Card Cage Assembly

The entire installation may be completed without r moving any circuit cards or other internal components. However, if maximum access is required, it may be more convenient to remove the card cage [illegible] mounting the housing. See removal instructions [illegible] section for the procedure.



Speedomax 25000 Recorder

Expansion Unit (Optional)

Figure 3-16
Speedomax 25000 Expansion Unit

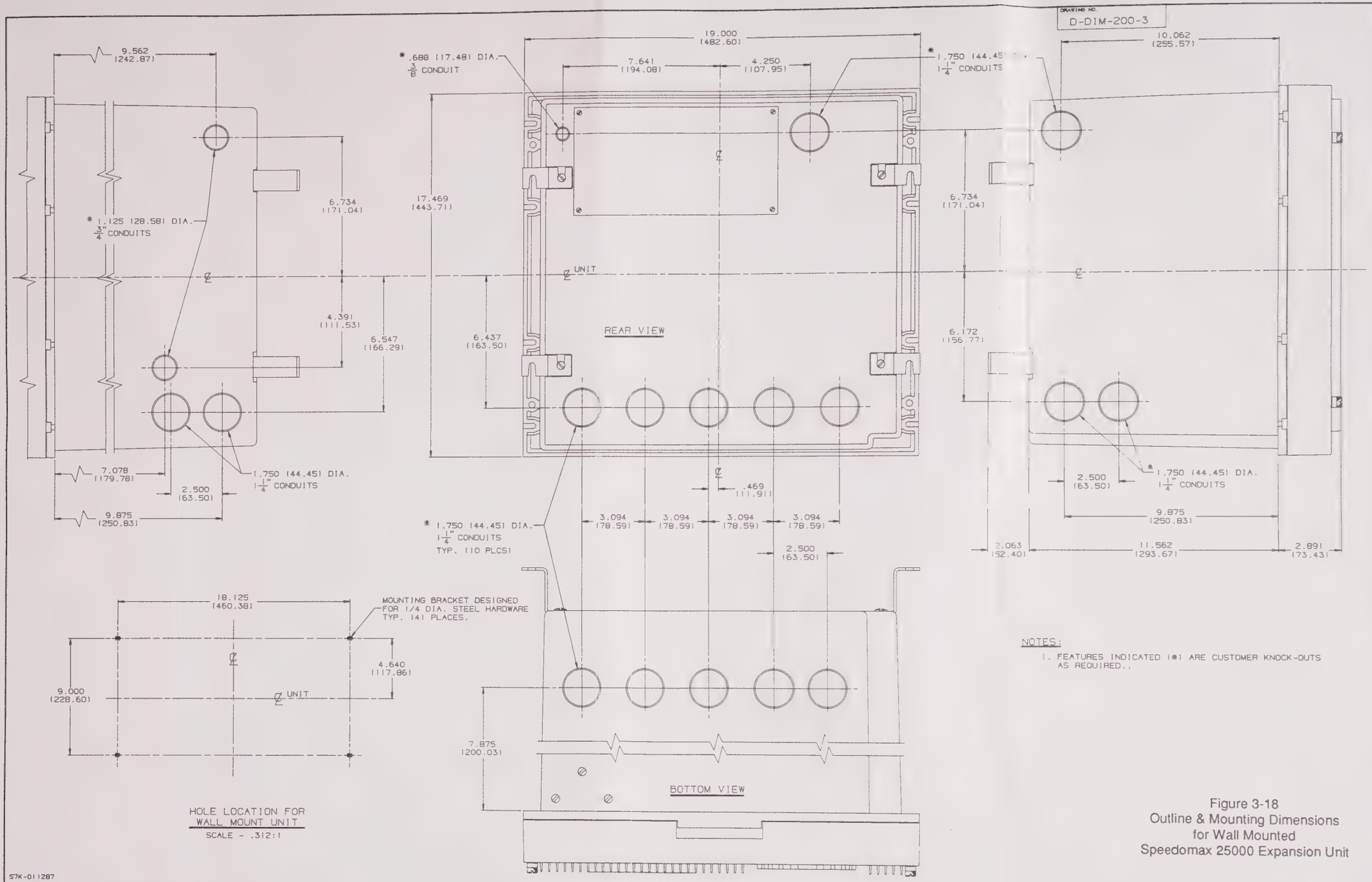
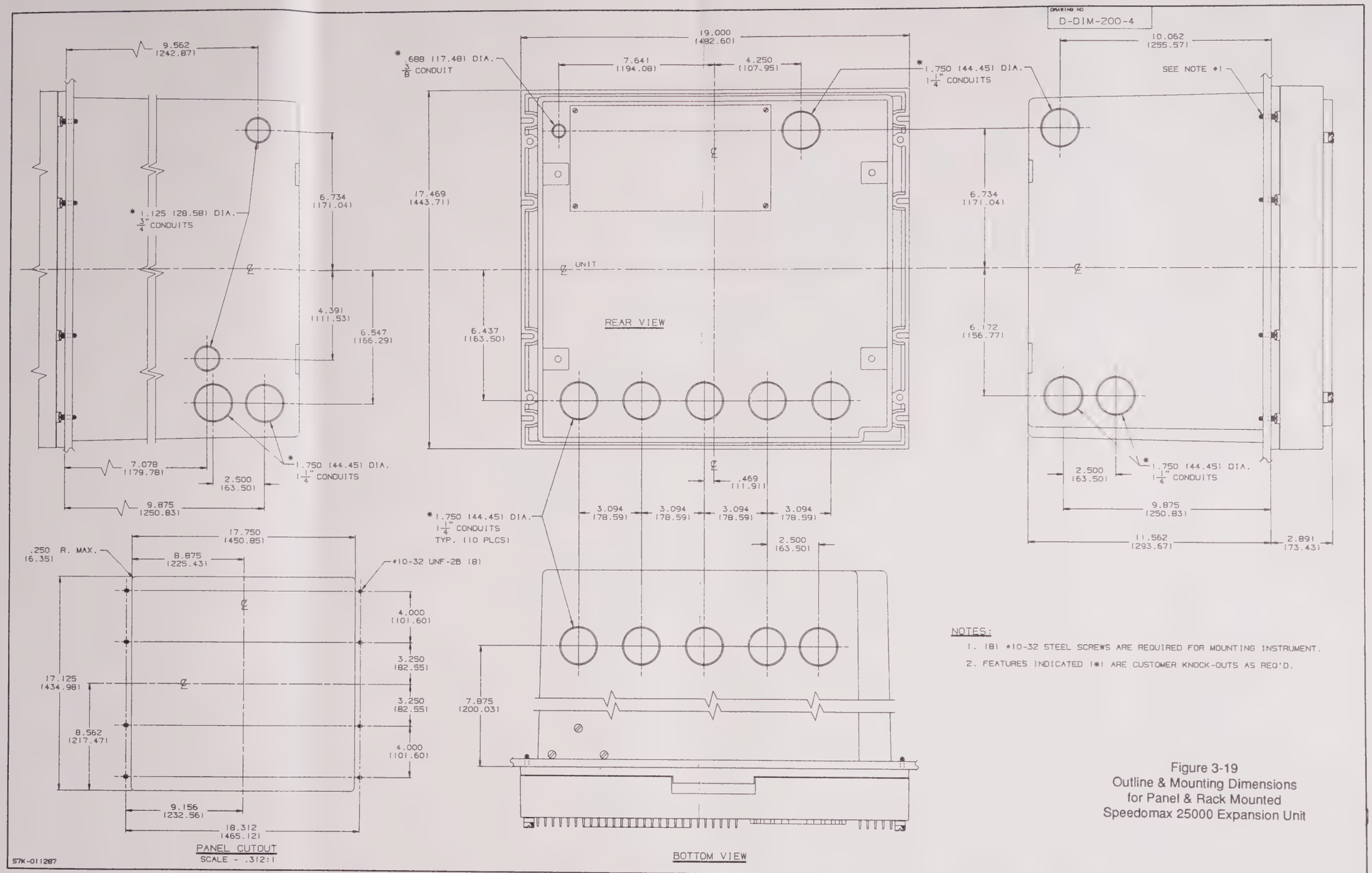


Figure 3-18
Outline & Mounting Dimensions
for Wall Mounted
Speedomax 25000 Expansion Unit



NOTES:

1. (8) *10-32 STEEL SCREWS ARE REQUIRED FOR MOUNTING INSTRUMENT.
2. FEATURES INDICATED (*) ARE CUSTOMER KNOCK-OUTS AS REQ'D.

Figure 3-19
Outline & Mounting Dimensions
for Panel & Rack Mounted
Speedomax 25000 Expansion Unit

3. Installation – Expansion Unit

CONNECTIONS

CAUTION

All wiring must be done by qualified technicians and must conform to national or local electrical codes.

General Wiring Recommendations

In general, stranded copper wire should be used for non-thermocouple electrical connections. Keep in mind that the maximum load resistance for many process instruments includes the interconnecting wire. Unless otherwise specified, input signal wiring does not have to be shielded, as long as it is not run with alternating current wiring which supplies switching circuits, such as motor starting loads, or is near strong electromagnetic fields.

Twisted signal pairs and shielded cable will improve noise immunity if wire routing is suspect. Terminals for shield connections are provided.

Observe all local electrical codes when making power connections.

In all installations, it is important to avoid cable or conduit arrangements which might allow moisture to collect in the housing. Plastic knockouts are provided for attachment of conduit. Remove the knockouts with a hammer and screwdriver where conduit openings are needed. Whenever possible, use the lower conduit openings. Unused openings should be plugged securely to prevent the entrance of moisture. If moisture condensation in conduit may be a problem, potting "Y" fittings or drip legs should be installed.

All electrical connections are made at the terminal strips on the rear inside surface of each housing. For access to the terminals, loosen four captive screws and lift off the front cover.

CAUTION

The cover is heavy and is retained only by four captive screws. Support its weight while unfastening the screws.

Release the card cage by pressing the latch at the right edge of the unit. Swing the card cage outwards to the left on its hinges (Fig. 3-17).

NOTE

All Expansion Units are shipped from the factory with circuit cards installed and labeled. Be sure any shipping pads or braces are removed. Do not apply any electrical inputs until connections are completed.

If more room is needed for making electrical connections, remove the card cage from its hinges and place it aside, using the following procedure:

1. Disconnect the card connectors (Fig. 3-20) from their associated slot positions by pulling each straight outward.

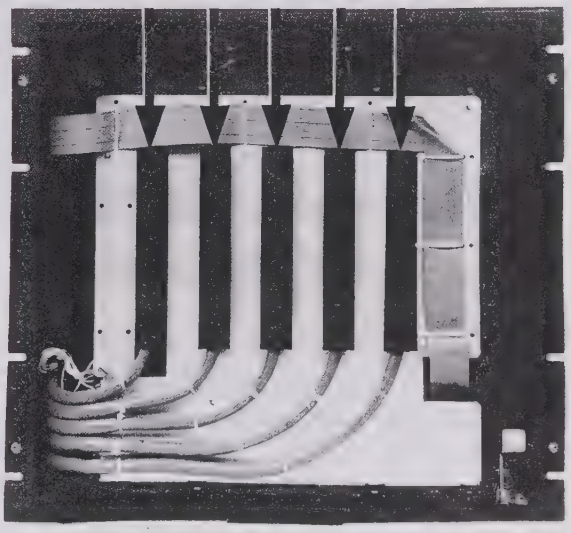


Figure 3-20
Disconnect Card Connectors

2. Disconnect two ribbon cable connectors, if present, on the front surface.

3. Remove the knurled nut to release the ground wire and to allow the power connector (Fig. 3-21) on the back left side to be disconnected. (Be sure to note the positions of the ground clamp and connectors for reassembly.)

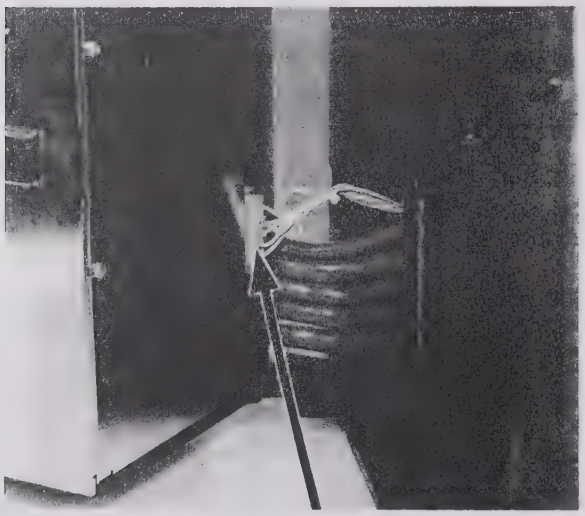


Figure 3-21
Power Connector

4. Disengage the cable track by "peeling" it from velcro tabs (located on the right hand side of the plate). See Figure 3-22.

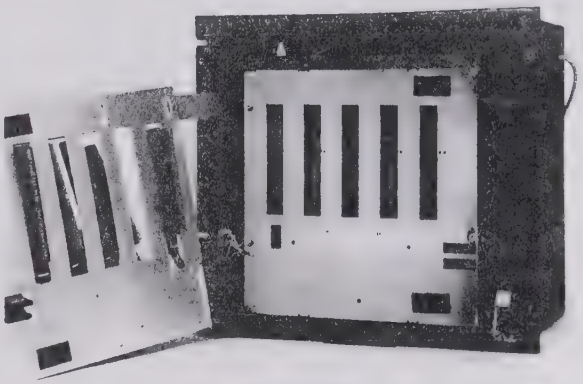


Figure 3-22
Cable Support Plate

5. Lift the card cage assembly from its two hinges (Fig. 3-23) and place it aside.

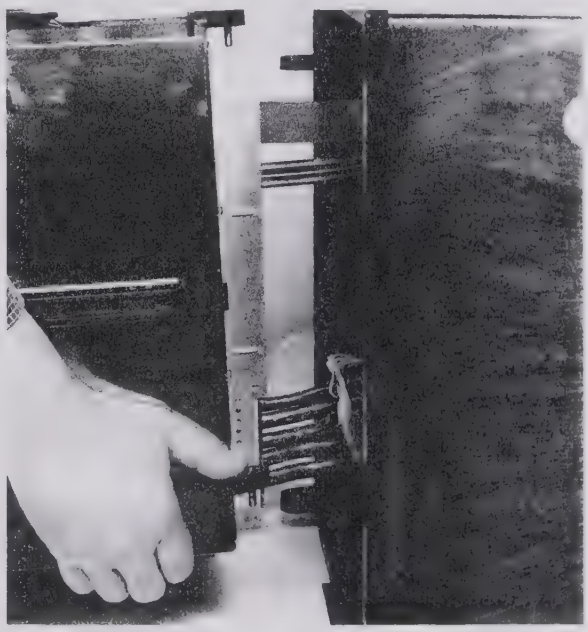


Figure 3-23
Card Cage Assembly

3. Installation – Expansion Unit

Power Connections

CAUTION

- ***Power must always be disconnected from the housing whenever circuit cards or other components are installed or removed, or when any electrical connection is made.***

- ***Always power up the Expansion Unit before powering up the Recorder. Always power down the Recorder before the Expansion Unit. In other words, always turn the Recorder ON or OFF while the Expansion Unit is ON.***

The power supply voltage must be within the limits stated in the Specifications.

NOTE

All units are shipped for operation on 120 VAC, 50/60 Hz or 220/240 VAC, 50/60Hz. Field conversion is jumper selectable (ballast and starter for fluorescent light must be changed).

Remove the access cover and connect the AC power leads to the terminal board inside the power supply compartment at the top rear of the case. Connect the hot side of the line to terminal L1 and the grounded side of the line to terminal L2 .

If the L2 side of the line cannot be grounded, add an isolating transformer electrically between the power supply and the unit and ground the L2 terminal.

NOTE

The ground terminal must be connected to a reliable earth ground for proper operation and in order to comply with OSHA and other safety codes.

Power Switch

A power switch for turning power ON and OFF is located on the power supply (Fig. 3-24).

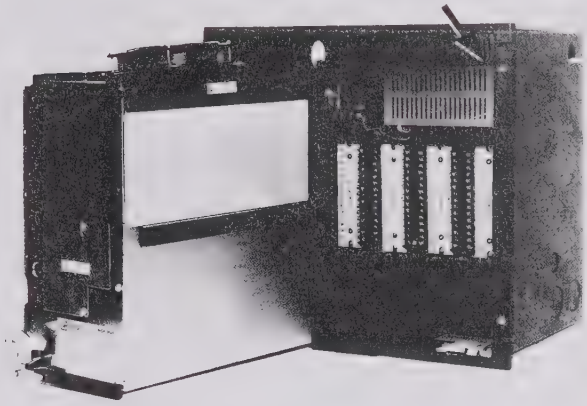


Figure 3-24
Power Switch

NOTE

There is a fuse in the power supply which should be replaced only by authorized service personnel.

Data Cable Connections

The data cable between the SPEEDOMAX 25000 and the Expansion Unit connects to the 26 pin connectors at the upper left rear of the Expansion Unit (left connector only) and next to the power terminals of the Recorder (Fig. 3-4).

SIGNAL INPUT AND OUTPUT WIRING FOR EXPANSION UNIT

Terminal configurations for Expansion Units are factory-assigned according to the circuit cards installed. Terminal labels are supplied with each unit on the card cage cover, which is visible when the card cage is swung out on its hinges.

Make connections to Expansion Unit terminals in exactly the same way as previously described for the Recorder (see Signal Input and Output Wiring).

SECTION 4
CONTROLS & INDICATORS

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DISPLAY 4-10

4. Controls & Indicators

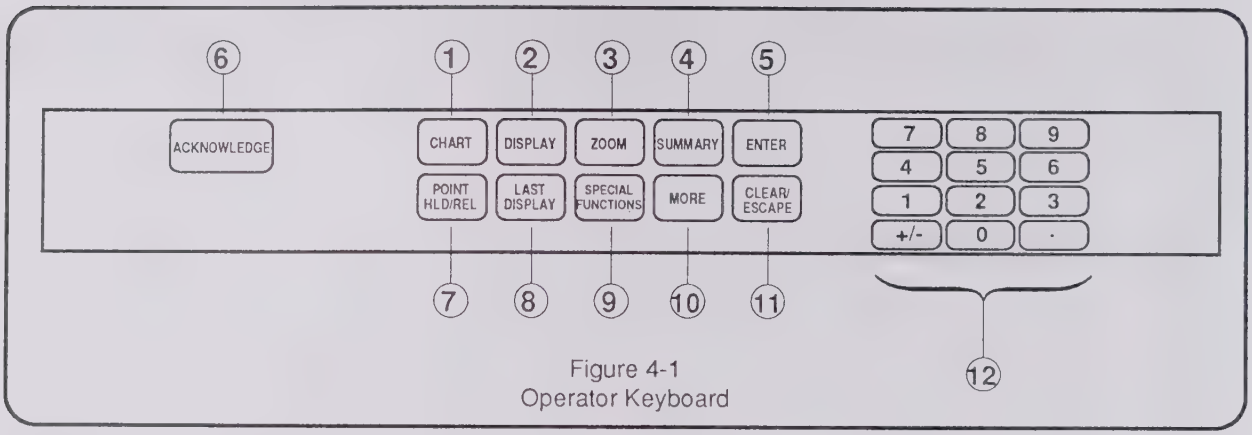


Figure 4-1
Operator Keyboard

OPERATOR KEYBOARD (Fig. 4-1)

NOTE

Base Catalog Number 25010, Recorder With Foreign Languages, is supplied with an operator keyboard that has a replaceable legend plate insert. The legend plate that is installed is in English. Legend plates in other languages are supplied loose. Symbols 1 to 11 in Figure 4-1 are those that appear in other languages. The legend plate can be changed as follows:

There is a latch behind the right side of the operator keyboard (see Figure 8-2). Reach in and depress this latch and swing the keyboard forward. It is hinged at the bottom. The English legend plate slides out from the left side. Remove the English legend plate and slide the desired legend plate into the keyboard. To change all displays, prompts, etc. to the selected language, refer to "General Procedure - Base Catalog Number 25010, Recorder with Foreign Languages" in Section 6, Programming.

① CHART

This key controls the operation of the chart. Press **CHART** for the following menu selections:

```
SELECT CHART FUNCTION

1-LO SPEED 25CM/HR 2-HI SPEED 120CM/HR 3-CHART FEED
4-OFF 5-TRENDVUE 6-TREND 7-DATALOG 8-RESUME DATALOG 9-QUIT
```

The two chart speed selections are determined by programming and each may be set to a value between 1 and 200 cm/hr in 1 cm/hr increments.

CHART FEED will advance the chart paper rapidly. Rapid feed will stop when any key is pressed, or when 1 meter of paper has been fed. OFF will stop paper feed and printing entirely. The TRENDVUE feature automatically advances and retracts the chart paper a small amount, so that while the printhead is not actually printing, the most recently printed portion of the chart is more readily visible.

The TREND selection starts printing of trendlines f individual points or groups of points. The DATALOG selection similarly starts printing of data in tabular form for points or groups of points. RESUME DATALOG restores datalogging in process when OFF was used. QUIT returns the display to the display which was interrupted when **CHART** was pressed.

② DISPLAY

This key is used to present data on the dot matrix display for review by the operator. Data will be shown sequentially, with each point or group of points displayed for a few seconds and then followed by the next point or group. Press **DISPLAY** for the following menu selections:

```
SELECT DISPLAY

1-ALL POINTS 2-SINGLE GROUP 3-MULTIPLE GROUPS 4-ALL ANALOG
5-ALL DISCRETE 6-FORMAT 7-TIME PER DISPLAY 8-QUIT
```

Selecting SINGLE GROUP or MULTIPLE GROUPS will cycle the display through a presentation of all data points within a specified group or groups of points, or point at a time, or several, depending on Format selection.

4. Controls & Indicators

Selecting ALL POINTS will cycle the display through a presentation of all data points, one at a time, or several at a time, depending on format selections (see FORMAT, below). Selecting ALL ANALOG or ALL DISCRETE will present similar displays, limited respectively to only analog or discrete data.

The FORMAT selection defines how data will be presented on the display. Single point data can be shown in double (enhanced) size with scale and pointer or with a bar graph. A multiple point display will show values of 15 data points simultaneously.

TIME PER DISPLAY specifies how long each individual data display will be shown before the display automatically sequences to show the next item. Select TIME PER DISPLAY and enter the desired number of seconds.

QUIT returns the display to the display which was interrupted when **DISPLAY** was pressed.

③ ZOOM

This key is used to magnify the scale of points being trended for better visibility. This feature is useful when multiple chart trendlines overlap and confuse readings. The zoom feature expands a chosen portion of the chart scale to full chart width and also correspondingly magnifies the scale which appears on the display. Press ZOOM for the following menu selections:

The ZOOM POINT DISPLAYED selection designates the point currently being displayed as the zoom reference point. SELECT ZOOM REFERENCE POINT allows any data point to be designated as the zoom reference. UNZOOM returns the chart and display to normal operation. DISPLAY ZOOMED POINTS presents a tabular listing on the display of all the data points currently in Zoom mode.

QUIT returns the display to the display which was interrupted when **ZOOM** was pressed.

④ SUMMARY

This key is used to print various types of data summaries on the full width of the chart (except the right margin). These printouts will interrupt trending, datalogging, or other functions in process and return to those functions automatically when the summary printouts are complete. Press **SUMMARY** for the following menu selections:

Each selection will start printout of the specified type of data. Additional keyed requests will be queued. Selecting another summary will result in that summary being printed immediately following completion of the summary currently printing.

⑤ ENTER

The **ENTER** key is used to execute selections and to enter values. **ENTER** must be pressed to enter each numerical value in response to a prompt, such as, for example, ENTER AI NUMBER.

⑥ ACKNOWLEDGE

This key is used to acknowledge and display alarms and diagnostic messages. See the Operating Procedures sections for descriptions of these functions.

⑦ POINT HLD/REL

The **POINT HLD/REL** key allows the operator to isolate one data point for continuous monitoring either on the display alone, the chart alone, or on both simultaneously. Press **POINT HLD/REL** for the following menu selections:

Select DISPLAY to review one data point on the dot matrix display only and not on the chart. Operation of the chart will be unaffected. Likewise, select CHART to present the single point data on the chart only . When the point is selected, the display will return automatically to whatever activity was current when **POINT HLD/REL** was pressed.

DISPLAY AND CHART will present data for a single point on both the chart and the display. Press **POINT HLD/REL** to cancel this function and return the chart and display to whatever was current when **POINT HLD/REL** was first pressed.

Except for "Chart Hold Only" mode, a prompt will be shown in place of the group number on the display to alert the operator that a hold is in effect and that trending or datalogging functions may be in an interrupted condition. The prompt will be HOLD. If only a chart hold is in effect, the prompt will not appear.

⑧ LAST DISPLAY

This key is useful for switching between two displays repeatedly. Press **LAST DISPLAY** to change the display to whatever was the previous on-line display. This key is active in Run mode only.

⑨ SPECIAL FUNCTIONS

This key allows the operator to review and to make on-line changes to parameters and functions. Press **SPECIAL FUNCTIONS** for the following menu selections:

SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
3-FORCE 4-ALARM SETPOINTS 5-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT

The DISPLAY DATE/TIME selection will cause the date and time to appear on the display, overwriting whatever display is present at the time. The date and time will remain on the display until **ESC** is pressed.

The DIAGNOSTIC MESSAGES selection allows review of all current diagnostic messages, using the **MORE** key, if necessary. The option of deleting all diagnostic messages is available within this selection. It is necessary to press **CLEAR/ESCAPE** to exit this selection and return to Run mode.

The FORCE selection allows the operator to force discrete inputs or outputs ON or OFF. Entry of the operator's Security Code will be requested by a prompt. The security code must be keyed in to enter this mode. The use of the **FORCE** function in conjunction with **UNFORCE** and **DONE** keys is explained in the Operating Procedures section.

The ALARM SETPOINTS selection allows the operator to change alarm setpoints on-line. Entry of operator's Security code will be requested by a prompt to enter this mode. Similarly, the remaining selections allow on-line changes to constant values, calibration, and emissivity values. QUIT will return the display to the display which was interrupted when **SPECIAL FUNCTIONS** was pressed.

⑩ MORE

This key is only active when the prompt MORE is on the display, indicating that there is more data than can be fit on the display at one time. Press **MORE** to review the additional data. It may be necessary to press **MORE** several times to review very large groups of data.

⑪ CLEAR/ESCAPE

This key has two functions. The **CLEAR** function will allow an incorrectly keyed numerical value to be deleted so that the correct entry can then be made. This must be done while the prompt ENTER NUMBER is displayed (before **ENTER** is pressed after keying in the incorrect number). When numerical entry is not the current activity, this key's **ESCAPE** function is active. Press **CLEAR/ESCAPE** to change the display from the current menu level to the previous (higher) menu level.

⑫ Numerical Keypad

These keys are used to enter numerical values when the prompt to ENTER NUMBER appears. They are also used to select numbered menu items as indicated on the display during operation.

4. Controls & Indicators

PROGRAMMING KEYBOARD

The Recorder utilizes the industry standard IBM PC AT style keyboard or a specially designed SPEEDOMAX 25000 hand-held keyboard for programming. An IBM PC or XT keyboard may also be used. All will plug into the receptacle on the front of the Recorder (Fig 4-2).

Figure 4-2
Programmer's Keyboard Connected

NOTE

The IBM AT and SPEEDOMAX 25000 keyboards are functionally interchangeable without adjustments. However, if an IBM PC or XT keyboard is to be used, a circuit card jumper and DIP switch in the SPEEDOMAX 25000 must be reset. Refer to the Installation section for instructions.

Figure 4-3 illustrates the hand-held keyboard key layout and the corresponding IBM function keys to be used for keys not appearing on the IBM AT keyboard. Except for the indicated function keys, all key actions are the same. The following descriptions of the hand-held key functions apply, therefore, to all.

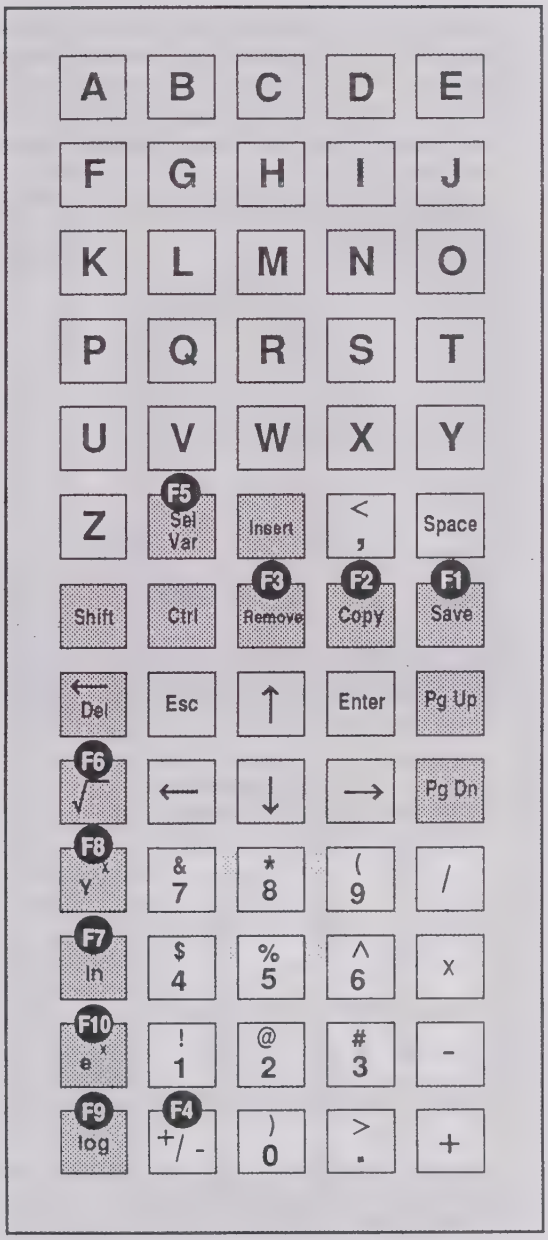


Figure 4-3
Speedomax 25000
Programmer's Keyboard

4. Controls & Indicators

The AT-style programming keyboard is provided as standard and the hand-held keyboard is available as an option (see Specifications). For multi-recorder installations, one keyboard can be used for several recorders. Provision has been made for storing the hand-held keyboard within the Recorder case when not in use (Fig. 4-4).

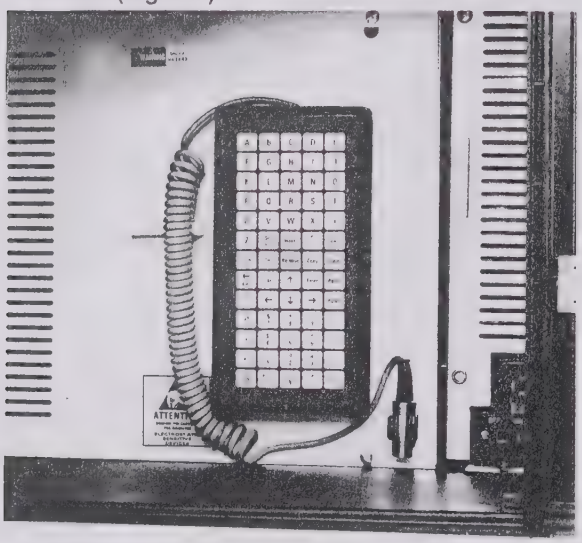
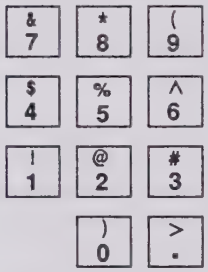
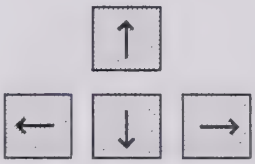


Figure 4-4
Storing the Keyboard

The hand-held keyboard is a membrane type with dome switch type tactile feedback. Pressing and holding a key will cause repeat entries. Key functions are as follows:

4. Controls & Indicators

Hand Held Keyboard	Description
	The letter keys are used in text mode for entering text descriptions, tags, and for units of measure. When using the IBM keyboard, the Recorder will respond to either upper or lower case letters. All text displayed or printed by the Recorder will be in upper case. The comma is used in text mode only.
	Number Keys are used for entering numerical values such as constants, group numbers, AI, PP, AO numbers, etc. Numbers can also be used in text mode for labels. The decimal point is used either in numerical data entry, or in text mode as a period. Parentheses are used in pseudo point equations and may also be used in text mode.
	The horizontal cursor (arrow) keys are used to move the reverse video highlight or cursor to select items on the display. They are also used to move the auxiliary cursor when a selection such as point color is used. The left and right cursor keys will move the cursor one space to the left or right in the text entry mode. The cursor will move through the text without affecting the characters. When editing text, the cursor will select the point where the correction is to be made. The vertical cursor keys are used on multi-line displays to move the cursor from line to line with fewer keystrokes.
	The **ENTER** key is used to select actions after moving the cursor to the desired prompt. It is also used to enter numerical values when called for by the prompts on the display.
	The **ESCAPE** key is used to regress one menu level from the current level on the display. Successively pressing the ESC key will back the display up to the first level display in the programming mode. This key is also used to undo erroneous keystrokes during data entry.
	The **INSERT** key is used for editing "free form" pseudo point equations. It does not function in text mode.
	The **SAVE** key (F1 on the IBM keyboard) is used in the point or group setup modes to save new or edited entries. Press SAVE to send the point or group configuration to memory after the point is configured or edited.

4. Controls & Indicators

Hand Held Keyboard	Description
Copy	The **COPY** key (F2 on the IBM keyboard) is used to copy data point specifications (AI, PP, DI, DO or AO) to other points (other AI's, PP's, etc.) This feature is provided to reduce the need for repetitive keyboard entires. It is generally more efficient to copy a data point to another and revise the copy, than to key in the new point from scratch. For example, if AI1 is configured for a type J thermocouple with all the respective upper and lower limits, tags, descriptions, etc., this can be copied to points AI2 through 30, then each of the new points can be edited to change tags or other items.
Pg Up	The **PAGE UP** key is used in the point and group setup modes to return the display to the last (previous) point or group respectively.
Pg Dn	The **PAGE DOWN** key is used in the point and group setup modes to advance the display to the next point or group respectively.
← Del	The **DEL** key is used to destructively backspace in the text mode or when editing pseudo points. Press DEL to delete the highlighted character on the display and move the cursor one space to the left.
Remove	The **REMOVE** key (F3 on the IBM keyboard) is used to delete or deprogram parameters. REMOVE will: • Delete a pseudo point • Return a Group to UNASSIGNED • Return an alarm to N/A • Change a CN value to 0, remove tag, descriptor and change color to black • Return AI, AO, DI, or DO to default (unprogrammed) condition (no tag, descriptor, color black)
Sel Var	The **SEL VAR** (Select Variable) (F5 on the IBM keyboard) key is used to bring up the prompts AI PP AO CN NUMBER when configuring "free form" pseudo point equations.
$\sqrt{}$	Square root (F6 on the IBM keyboard) is used in pseudo point equations.
ln	Natural logarithm (F7 on the IBM keyboard) is used in pseudo point equations.
Y^x	Y raised to the x power (F8 on the IBM keyboard) is used in pseudo point equations.
log	Base ten logarithm (F9 on the IBM keyboard) is used in pseudo point equations.
e^x	e raised to the x power (F10 on the IBM keyboard) is used in pseudo point equations.

4. Controls & Indicators

Hand Held Keyboard	Description
A	Absolute value function is used in pseudo point equations.
+/ -	The +/- key (F4 on the IBM keyboard) is used to change the sign of a numeric entry.
+	The plus sign is used in text mode, in numerical data entry, and in setting up "free form" pseudo point equations.
-	The minus sign is used in text mode, in numerical data entry, and in setting up "free form" pseudo point equations.
x	The times or multiplication sign is used in text mode and in setting up "free form" pseudo point equations. The asterisk character (*) will be printed or displayed in text mode or in pseudo point equations to indicate the multiplication operation. (The asterisk key on this keyboard produces a text character only.)
/	The slash or division sign is used in text mode and in setting up "free form" pseudo point equations.
Ctrl	The **CTRL** key of the programming keyboard is used to duplicate certain key functions of the Operator's keyboard. (The Recorder can be both operated and programmed entirely from the programming keyboard, if desired. This includes hand-held, PC, XT and AT types.) Press and hold **Ctrl**, then press any of the following additional keys for the function indicated: **Key** — **Operator's Keyboard** Ctrl A — Acknowledge Ctrl C — Chart Ctrl D — Display Ctrl Z — Zoom Ctrl S — Summary Ctrl P — Point Hold Ctrl L — Last Display Ctrl F — Special Functions Ctrl M — More
Shift	The **SHIFT** key is used in the conventional manner to produce upper case characters as marked on the keys.

NOTE

When a key is held down on the hand-held keyboard, the repeat rate will be the same as the IBM AT keyboard.

NOTE

The following symbols are available for use as text only on both the hand-held keyboard and the IBM keyboard with the use of the SHIFT key.

*< & * $ % ^ ! @ # >*

4. Controls & Indicators

DISPLAY

The display is the primary interface between the SPEEDOMAX 25000 and its operator and programmer. The display is used in conjunction with the operator's keyboard (Fig. 4-5), to select chart parameters, select what data is to be printed and select how it is to be printed. While the chart is in operation, the display will present various other data selected by the operator. Operation of the display and the chart are completely independent of each other.

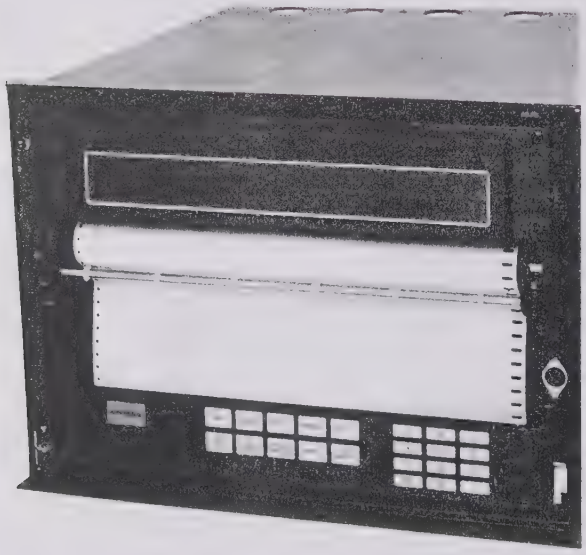


Figure 4-5
Operator's Keyboard & Display

When used in conjunction with the ***programmer's*** keyboard, the display presents simple step-by-step menu selections for programming all SPEEDOMAX 25000 functions.

The display is a gas plasma dot matrix type, 40 pixels (dots) high by 384 pixels wide. Display format is arranged to show four horizontal lines of 5x7 pixel characters. When displaying single point data, two lines are combined to present a double sized (10x14) character for increased visibility from a distance.

Figure 4-6 illustrates a display of an analog group of data. Other types are similar. The top line of the illustrated display shows active alarms. The notation "MORE" indicates that there are more active alarms than will fit on the display. The **MORE** key on the operator's keyboard will show the additional alarms.

A special feature of the SPEEDOMAX 25000 display is the accompanying scale below the digital data display. The scale may be shown with a pointer or a bar graph (shown) to illustrate the present value of the selected data point.

Some display formats include an arrow symbol to indicate the rate of change of the data point value displayed. The rate of change indicator value is % change in engineering units/minute. (Display formats are illustrated in the Operation section. See Figure 5-6). The arrow indications are as follows:

↑ Value increasing rapidly (≥ 20% of F.S.)

↗ Value increasing moderately (≥ 10% of F.S.)

→ Value changing less than ±10%

↘ Value decreasing moderately (≥ –10% of F.S.)

↓ Value decreasing rapidly (≥ –20% of F.S.)

A programming display is shown in Figure 4-7. Access to programming mode is obtained by plugging in the programmer's keyboard, pressing any key and then responding to screen prompts. See Section 6.

On programming displays, the bottom line of the display is the message line. Instructions for each display will appear on the message line. In the clock example, pressing **ENTER** will cause the display to present a menu of selections, each item accompanied by a message line to guide the programming process. Note in Figure 4-7 how moving the cursor to a different item changes the message line to a message referring to the new item.

As a further guide to simplify programming, the keys which are active for each display are also shown (Fig. 4-7). **ENTER** will proceed with the highlighted activity, **ESC** will cancel the display and display the previous (higher) level of the menu. The cursor (arrow) keys move the highlight.

4. Controls & Indicators

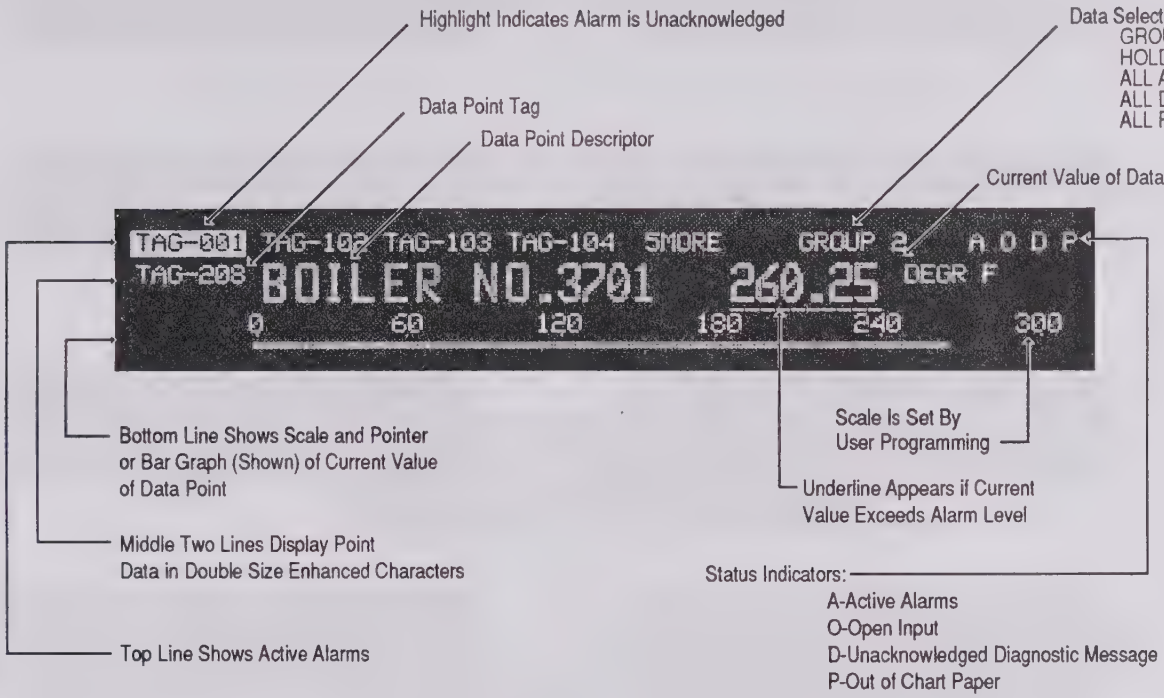


Figure 4-6
A Typical Single Point Data Display

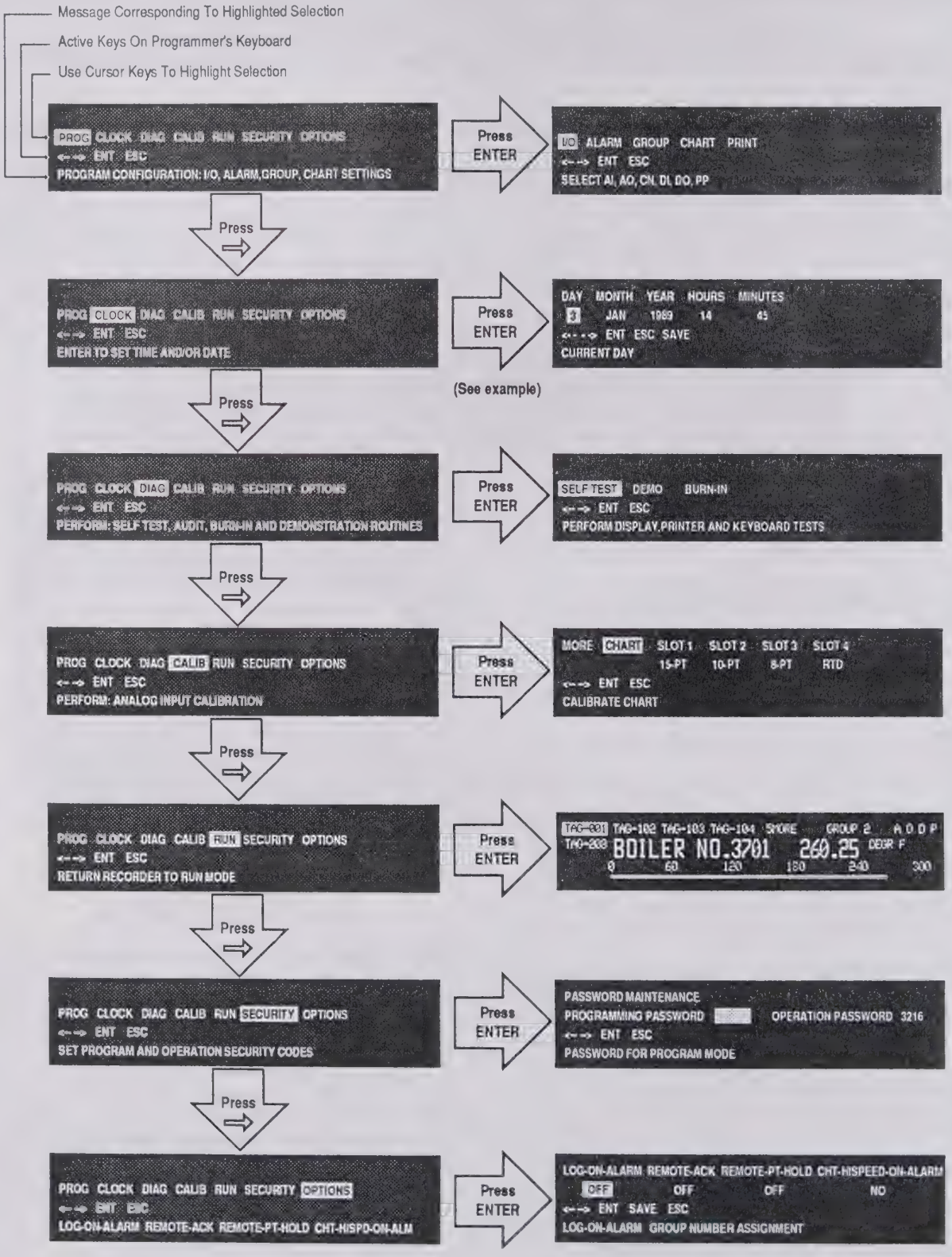

Message Corresponding To Highlighted Selection
Active Keys On Programmer's Keyboard
Use Cursor Keys To Highlight Selection
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
PROGRAM CONFIGURATION: I/O, ALARM,GROUP, CHART SETTINGS
Press ENTER
I/O ALARM GROUP CHART PRINT
<--> ENT ESC
SELECT AI, AO, CN, DI, DO, PP
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
ENTER TO SET TIME AND/OR DATE
Press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 14 45
<--> ENT ESC SAVE
CURRENT DAY
(See example)
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
PERFORM: SELF TEST, AUDIT, BURN-IN AND DEMONSTRATION ROUTINES
Press ENTER
SELF TEST DEMO BURN-IN
<--> ENT ESC
PERFORM DISPLAY,PRINTER AND KEYBOARD TESTS
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
PERFORM: ANALOG INPUT CALIBRATION
Press ENTER
MORE CHART SLOT 1 SLOT 2 SLOT 3 SLOT 4
15-PT 10-PT 8-PT RTD
<--> ENT ESC
CALIBRATE CHART
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
RETURN RECORDER TO RUN MODE
Press ENTER
TAG-001 TAG-102 TAG-103 TAG-104 SHORE GROUP 2 A D D P
TAG-208 BOILER NO.3701 260.25 DEGR F
0 60 120 180 240 300
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
SET PROGRAM AND OPERATION SECURITY CODES
Press ENTER
PASSWORD MAINTENANCE
PROGRAMMING PASSWORD OPERATION PASSWORD 3216
<--> ENT ESC
PASSWORD FOR PROGRAM MODE
Press
PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC
LOG-ON-ALARM REMOTE-ACK REMOTE-PT-HOLD CHT-HISPD-ON-ALM
Press ENTER
LOG-ON-ALARM REMOTE-ACK REMOTE-PT-HOLD CHT-HISPEED-ON-ALARM
OFF OFF OFF NO
<--> ENT SAVE ESC
LOG-ON-ALARM GROUP NUMBER ASSIGNMENT

Figure 4-7
Top Level Programming Menus

EXAMPLE

Changing Time from 2:45 P.M. to 3:55 P.M.

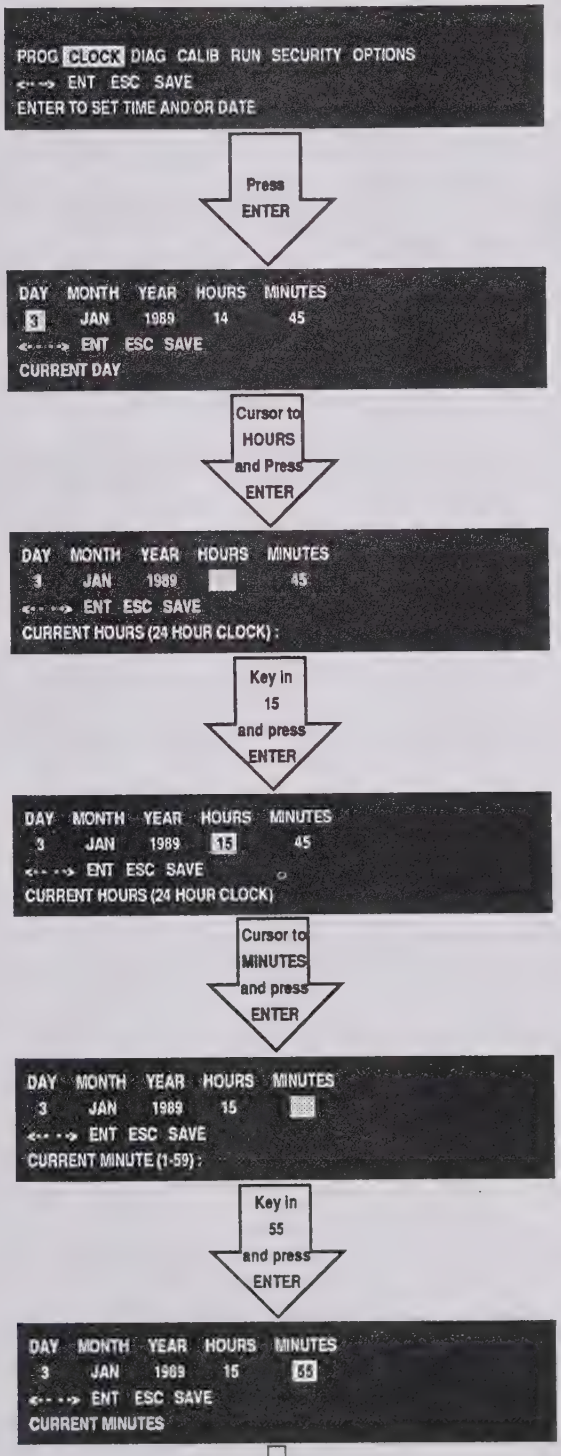

PROG CLOCK DIAG CALIB RUN SECURITY OPTIONS
<--> ENT ESC SAVE
ENTER TO SET TIME AND/OR DATE
Press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 14 45
<----> ENT ESC SAVE
CURRENT DAY
Cursor to HOURS and Press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 45
<----> ENT ESC SAVE
CURRENT HOURS (24 HOUR CLOCK) :
Key in 15 and press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 15 45
<----> ENT ESC SAVE
CURRENT HOURS (24 HOUR CLOCK)
Cursor to MINUTES and press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 15
<----> ENT ESC SAVE
CURRENT MINUTE (1-59) :
Key in 55 and press ENTER
DAY MONTH YEAR HOURS MINUTES
3 JAN 1989 15 55
<----> ENT ESC SAVE
CURRENT MINUTES
COMPLETE - PRESS SAVE

Figure 4-7 (con't)

SECTION 5
OPERATION

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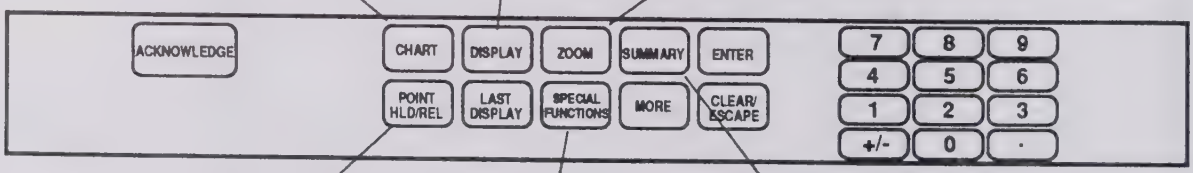
SPEEDOMAX 25000
Quick Reference Card
Keyboard Menu Selections

(The Recorder can also be operated entirely from the Programming Keyboard. See instructions for the Ctrl Key in Controls and Indicators - Programming Keyboard Section)

1-LO SPEED 25 CM/HR
2-HI SPEED 120 CM/HR
3-CHART FEED
4-OFF
5-TRENDVUE
6-TREND
7-DATALOG
8-RESUME DATALOG
9-QUIT

1-ALL POINTS
2-SINGLE GROUP
3-MULTIPLE GROUPS
4-ALL ANALOG
5-ALL DISCRETE
6-FORMAT
7-TIME PER DISPLAY
8-QUIT

1-ZOOM POINT DISPLAYED
2-SELECT ZOOM REFERENCE POINT
3-UNZOOM
4-DISPLAY ZOOMED POINTS
5-QUIT



1-DISPLAY
2-CHART
3-DISPLAY AND CHART
4-QUIT

1-DISPLAY DATE/TIME
2-DIAGNOSTIC MESSAGES
4-FORCE
5-ALARM SETPOINTS
6-CONSTANT VALUES
7-ON LINE CALIBRATION
8-EMISSIVITY
9-QUIT

1-ACTIVE ALARMS
2-ALARM HISTORY
3-ANALOG
4-DISCRETE
5-ALL DATA
7-DIAGNOSTIC SUMMARY
8-STOP PRINT
9-QUIT

5. Operation

OPERATING PROCEDURES

In the previous section, "Controls and Indicators," the functions of the display and each of the operator's keys was described. These key functions are summarized on the previous page for reference. This section provides instructions for operating the SPEEDOMAX 25000 Recorder.

STARTUP

CAUTION

When an optional Expansion Unit is installed, always power up the Expansion Unit before the Recorder and power down the Recorder before the Expansion Unit. In other words, Expansion Unit power must always be ON whenever you switch the Recorder ON or OFF. If error messages occur at startup, check to be sure that the units have been powered up in the proper sequence.

Whenever power to the Recorder is turned on, the status indicator D will appear at the upper right of the display, indicating the presence of a diagnostic message. Press the **ACKNOWLEDGE** key to acknowledge the message. The display will show 03A WARM START RESET and the current time. This message indicates that information such as alarm history, discrete outputs, diagnostic history, time-dependent calculations, chart and display formats and other information has been retained in memory since the last time power was turned off. This message indicates normal function and will appear any time power is turned off and on again.

The subject of diagnostics is covered in detail in Service Manual No. 277801. Refer to the Appendix of this Operator's Manual for a complete listing of error messages that may appear on the display during normal operation and programming of the Recorder.

SETUP

The SPEEDOMAX 25000 is operated by use of the front panel keyboard and display. Many operating functions will depend on how the SPEEDOMAX 25000 is programmed. Programming is a separate function which utilizes a different keyboard. Complete instructions for programming are provided in Section 6 of this manual. This Operating Procedures section describes all activities which may be performed by the operator and presumes that programming will have been completed by the user previously.

Because the SPEEDOMAX 25000 is shipped fully configured with default values in memory, operation is possible as soon as it is installed and power is applied. While no programming is required to begin operation, as a practical matter it will be desirable for most users to configure their data to make the Recorder output useful. Data configuration will include assigning text labels and tags to data points, defining group of points for convenient handling and comparison, and establishing scales and ranges of values. How to accomplish these, and many other configuration functions, is described fully in the Programming section.

If Base Catalog Number 25010, Recorder with Foreign Languages is supplied, refer to "Operator Keyboard" in Section 4, Controls & Indicators, for changing the operator keyboard legend plate and to "General Procedure" in Section 6, Programming, for changing the operating language.

5. Operation

DATA

Individual data points are identified by parameter type and number. For example, AI20 identifies Analog Input Number 20. Refer to the Programming section for more information on data designations. The following symbols are used in the SPEEDOMAX 25000:

AI	Analog Input
AO	Analog Output
PP	Pseudo Point
CN	Numerical Constant
DI	Discrete Input
DO	Discrete Output
PD	Pseudo Point with a Discrete Output

The SPEEDOMAX 25000 is designed to record and process data in groups of points. By defining several data points as a "group," the entire group may be printed as trendline plots, similar in appearance to a conventional multichannel recorder. By assigning the groups with software, the SPEEDOMAX 25000 may "softwire" any desired data into the available "channels" of the Recorder.

Defining groups is part of the programming process. If no groups are programmed by the user, the SPEEDOMAX 25000 will automatically assign points to groups as a default function. (The SPEEDOMAX 25000 recognizes all of its installed I/O terminals and automatically assigns data point numbers to them, so it has the necessary information without need for intervention by the operator or programmer.) Refer to the Programming section for more information on group assignments.

Most operations require that you specify a group number. A group can contain from 1 to 30 points. Several groups can be trended on a chart simultaneously, with a maximum of 30 total points for all groups at one time.

SECURITY

The SPEEDOMAX 25000 Recorder can be programmed to require a security code entry by the operator for some operations. The security code is a four character code to be entered on the numerical keypad of the operator's front panel keyboard when the prompt ENTER SECURITY CODE appears. The actual code is determined by user programming (See Section 6). If no code number is programmed, this security feature will be inactive and pressing **ENTER** in response to ENTER SECURITY CODE will allow full access.

If a code has been programmed which is not available to the operator, a "View Only" feature is provided to allow protected data values to be seen but not changed.

Programming requires a different code entry for access. See the Programming section for complete information.

5. Operation

CHART OPERATING PROCEDURES

Chart functions are entirely independent from display functions. The following procedures will explain how to use the keyboard and display to operate the chart. These procedures will temporarily interrupt whatever is being displayed, but when each procedure is complete, the display will return automatically to its interrupted function.

SET CHART SPEED

Two choices of chart speed are available, low (Lo) and high (Hi). The speeds are set by user programming. If not programmed, default speeds of 6 cm/Hr and 100 cm/Hr will be applied. Set the speed as follows:

1. Press **CHART**. The display will show:

SELECT CHART FUNCTION
1-LO SPEED 25CM HR 2-HI SPEED 120CM HR 3-CHART FEED
4-OFF 5-TRENDVUE 6-TREND 7-DATALOG 8-RESUME DATALOG 9-QUIT

2. Press numeral **1** key for low speed or numeral **2** key for high speed. The selected speed will be highlighted on the display. The speed will be in effect immediately and the display will return to whatever was displayed before pressing **CHART**.

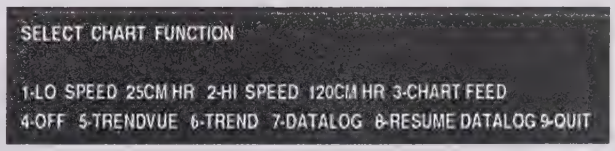
NOTE

The Recorder may be programmed to switch the chart to high speed by remote command or on occurrence of an alarm. See "Configuring Chart and Print Functions" in Section 6, Programming. If these functions are programmed, ***low*** *speed operation will only be possible if all three (keyboard, remote command, and alarm) are in* ***low speed*** *selection mode.*

PAPER FEED

To start or stop paper feed, proceed as follows:

1. Press **CHART**. The display will show:


SELECT CHART FUNCTION
1-LO SPEED 25CM HR 2-HI SPEED 120CM HR 3-CHART FEED
4-OFF 5-TRENDVUE 6-TREND 7-DATALOG 8-RESUME DATALOG 9-QUIT

2. For rapid feed of paper, press the numeral **3** key. Paper will feed through the recorder at high speed. Press the **3** key again to return the feed rate to normal. (If this is not done, the chart will automatically stop after 1 meter of paper has been fed through at high speed.) To return the display to whatever was displayed when you pressed **CHART**, press the **9** key, to QUIT.

To stop paper feed and printing entirely, press the numeral **4** key. Chart movement will stop and the display will return to whatever was displayed when you pressed **CHART**. To restore chart feed, press **CHART** followed by the **1**, or **2** keys to resume a Trend, or **8** key to resume a Datalog.

PRINTING TREND CHARTS

Figure 5-1 illustrates a typical SPEEDOMAX 25000 trend chart. To start printing a trend chart, proceed as follows:

1. Press **CHART**. The display will show:

```
SELECT CHART FUNCTION

1-LO SPEED 25CM/HR  2-HI SPEED 120CM/HR  3-CHART FEED
4-OFF  5-TRENDVUE  6-TREND  7-DATALOG  8-RESUME DATALOG 9-QUIT
```

2. Press numeral **6** key on the numerical keypad. The display will show:

```
SELECT TREND

1-ONE GROUP  2-MULTIPLE GROUPS TOGETHER
3-MULTIPLE GROUPS SEQUENTIALLY  4-SEQUENCE TIME  5-QUIT
```

3. To trend a single group of analog data points (groups are defined by user programming), press the numeral **1** key. To trend more than one group at the same time, press the numeral **2** key. A maximum of 30 data points can be trended (30 total for all groups added together). Only analog data can be trended.

Trending multiple groups together (**2** key) involves printing "split scale" formats. Split scale formats are established as part of group programming. See "Analog Group Programming" in Section 6 for information on printing groups in split scale formats.

Press the **3** key to print trends of two or more groups in sequence, one group at a time. Press the **4** key to specify the time, in minutes, for each group to be printed (in sequential mode only). (The **5** key will cancel your current entries and the trend selection and return the display and chart to whatever was interrupted when **CHART** was pressed).

4. If you selected a single group (**#1** key), key in the group number at the prompt and press **ENTER** to begin trending the group. For multiple groups, key in each group number , then press the **+/–** key to move the cursor to the right. Press **ENTER** following the final entry to begin trending. The groups will be trended in the order in which you entered them. For sequence time entry, key in the desired time, in minutes, and press **ENTER**.

If you key in an incorrect number, press **ESC** instead of **ENTER** to erase it and start over. If it has already been entered, position the cursor on the entry and press numeral **0** to delete it.The display will return automatically after the last **ENTER** to what was displayed when **CHART** was pressed, and the trend printout will begin immediately.

5. Operation

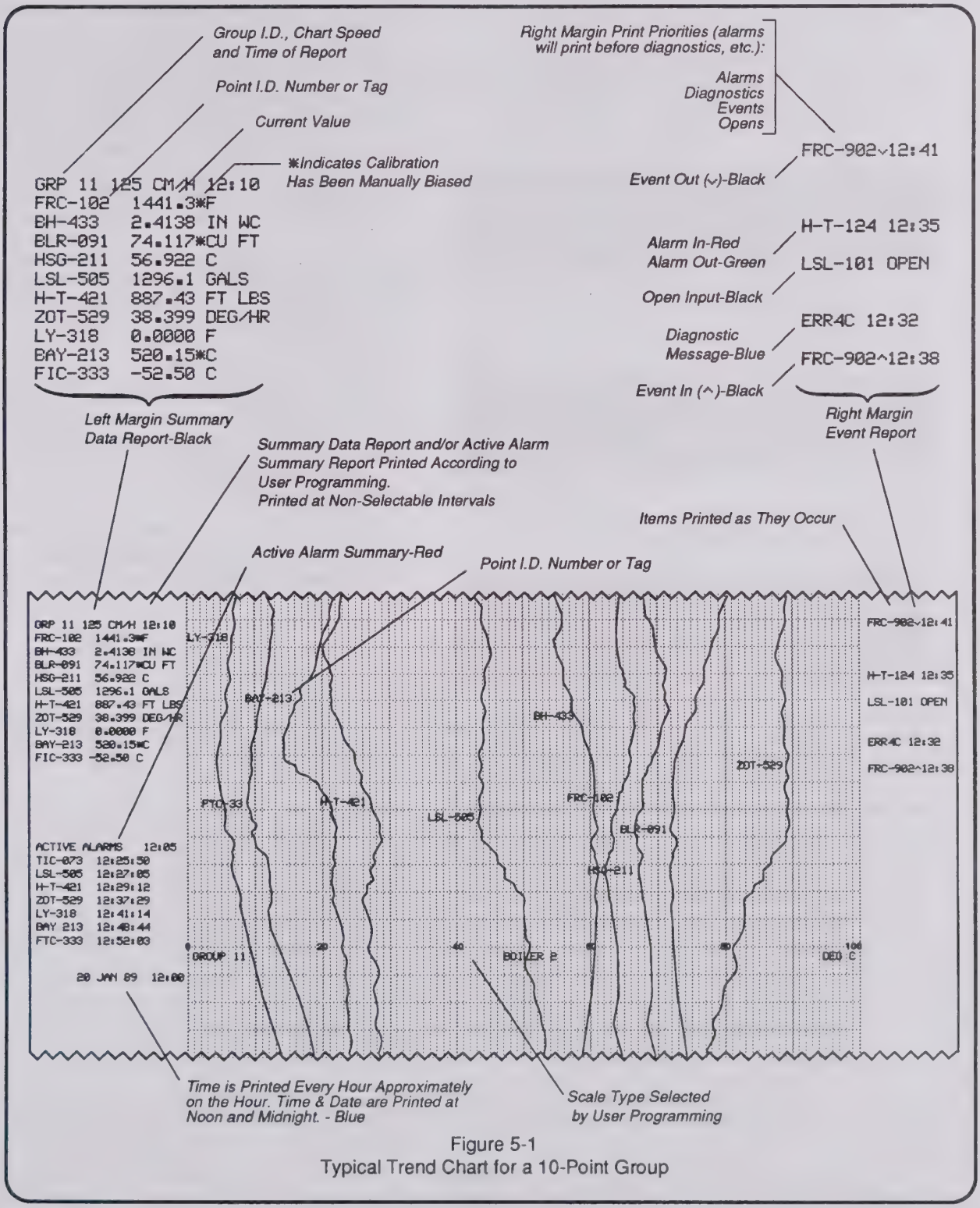
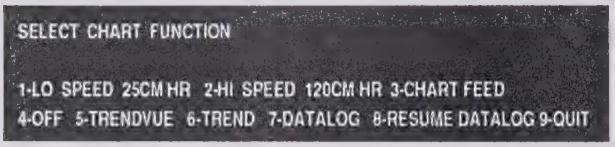


Figure 5-1
Typical Trend Chart for a 10-Point Group

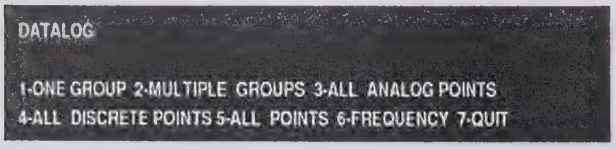
PRINTING DATALOGS

Figure 5-2 illustrates a typical datalog printout. To start datalogging on the chart, proceed as follows:

1. Press **CHART**. The display will show:


SELECT CHART FUNCTION
1-LO SPEED 25CM HR 2-HI SPEED 120CM HR 3-CHART FEED
4-OFF 5-TRENDVUE 6-TREND 7-DATALOG 8-RESUME DATALOG 9-QUIT

2. Press the numeral **7** key to select DATALOG. The display will show:



3. Press the numeral **6** key to set the datalog frequency. The display will show:

Key in a number for the time, in minutes, between repeat printouts and press **ENTER**. The previous display will be restored. If you do not enter a time, the value on the display (default value is 5 minutes) will be applied. The datalog type that you select in the next step of this procedure will be repeated at that interval.

It is not necessary to enter a datalog frequency each time you wish to print a datalog. The time you enter will remain the same until you change it, following this same procedure.

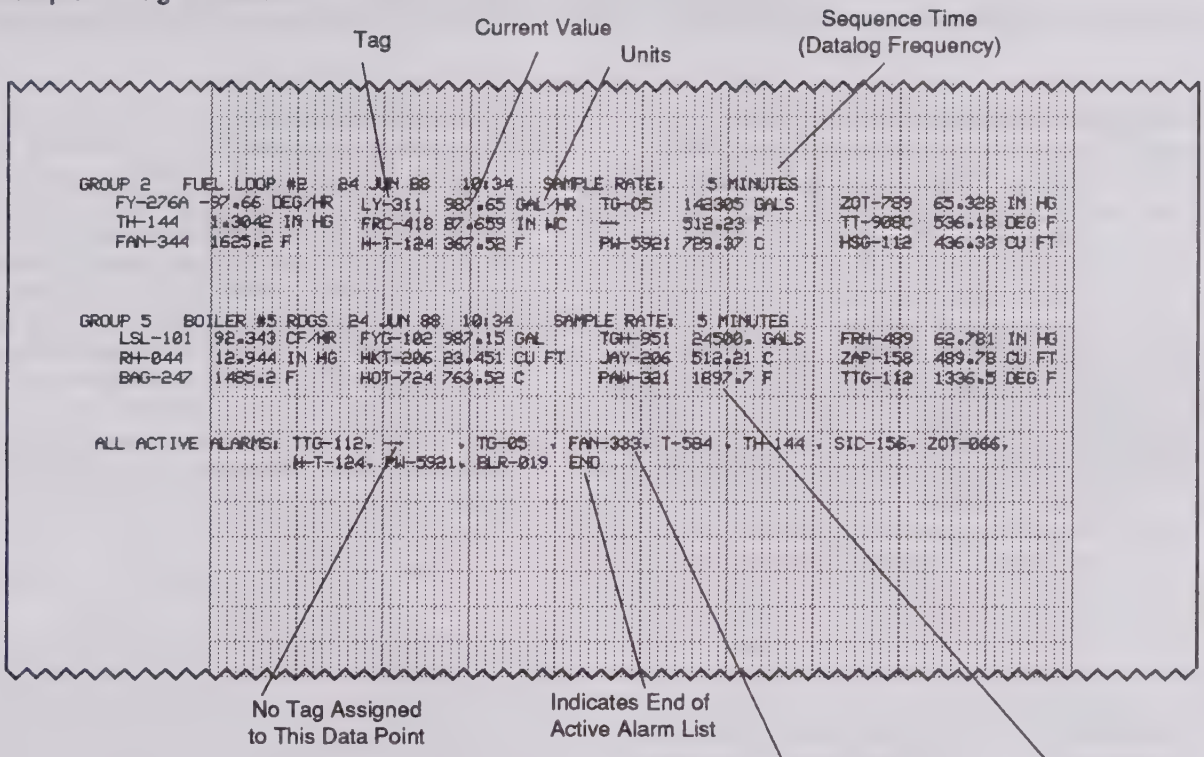
4. If you wish to print datalogs by group (selection 1 or 2), proceed to the next step (step 5). If you do not wish to log data by group number, press the numeral **3, 4,** or **5** key to print, respectively, a datalog of all analog points, all discrete points, or all data points including both analog and discrete. The datalog will be printed immediately and repeatedly thereafter at the "datalog frequency" you entered in the previous step. The display will return to what was displayed when **CHART** was pressed.

5. To select a single group for datalogging, key in the group number at the prompt and press **ENTER**. The datalog will be printed immediately and repeatedly at the "datalog frequency" you entered in step 3.

To select multiple groups for sequential datalogging, press the numeral **2** key. At the prompt, key in each group number, then press the **+/-** key to move the cursor to the right. Following the final entry, press **ENTER** to start the datalog printout. The groups will be logged in the order in which you entered them.

For single or multiple group selections, the display will automatically return to what was interrupted when **CHART** was pressed as soon as datalogging begins.

Example 1. Tag I.D. Mode


Tag
Current Value
Units
Sequence Time
(Datalog Frequency)
GROUP 2 FUEL LOOP #2 24 JUN 88 10:34 SAMPLE RATE: 5 MINUTES
FY-276A -97.66 DEG/HR LY-311 987.65 GAL/HR TG-05 142305 GALS ZOT-789 65.328 IN HG
TH-144 1.3042 IN HG FRC-418 87.659 IN WC --- 512.23 F TT-908C 536.18 DEG F
FAN-344 1625.2 F H-T-124 367.52 F PW-5921 729.37 C HSG-112 436.33 CU FT
GROUP 5 BOILER #5 RDGS 24 JUN 88 10:34 SAMPLE RATE: 5 MINUTES
LSL-101 92.343 CF/HR FYG-102 987.15 GAL TGH-951 24500. GALS FRH-489 62.781 IN HG
RH-044 12.944 IN HG HKT-206 23.451 CU FT JAY-206 512.21 C ZAP-158 489.78 CU FT
BAG-247 1485.2 F HOT-724 763.52 C PAW-321 1897.7 F TTG-112 1336.5 DEG F
ALL ACTIVE ALARMS: TTG-112, --- , TG-05 , FAN-333, T-584 , TH-144 , SID-156, ZOT-066,
H-T-124, PW-5921, BLR-019 END
No Tag Assigned
to This Data Point
Indicates End of
Active Alarm List
Active Alarms
Printed in Red
Data Printed
in Color
Programmed
for Group

Example 2. Point Number I.D. Mode

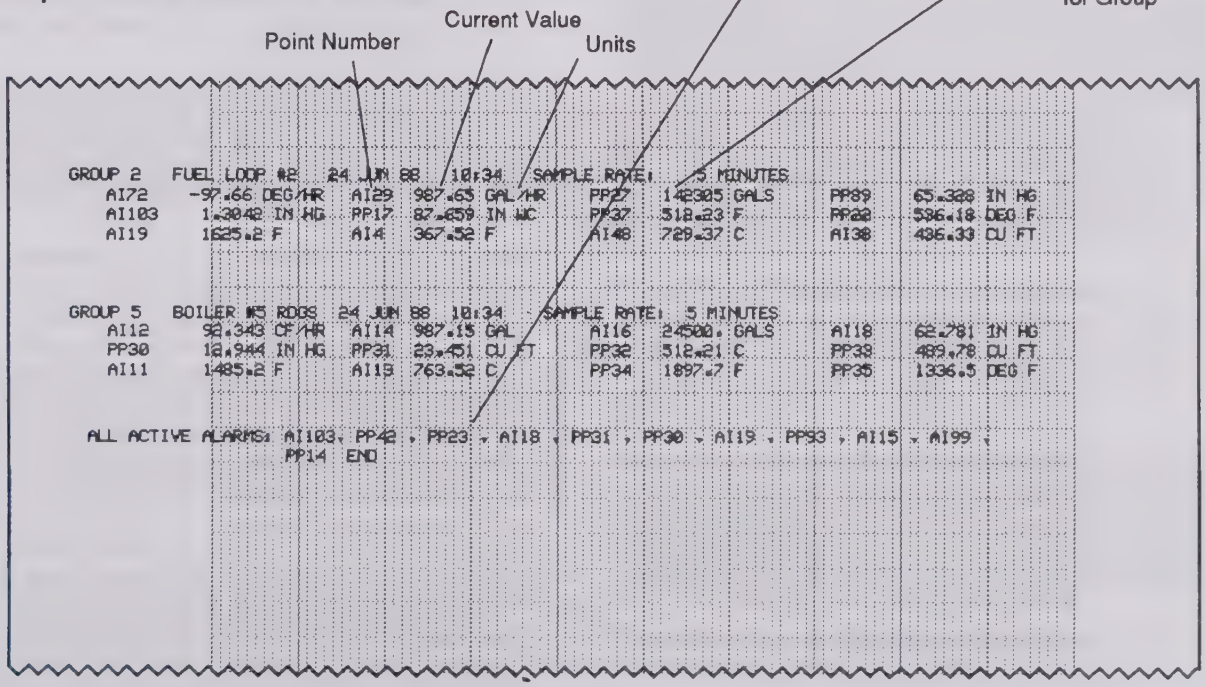

Point Number
Current Value
Units
GROUP 2 FUEL LOOP #2 24 JUN 88 10:34 SAMPLE RATE: 5 MINUTES
AI72 -97.66 DEG/HR AI29 987.65 GAL/HR PP27 142305 GALS PP89 65.328 IN HG
AI103 1.3042 IN HG PP17 87.659 IN WC PP37 512.23 F PP28 536.18 DEG F
AI19 1625.2 F AI14 367.52 F AI48 729.37 C AI38 436.33 CU FT
GROUP 5 BOILER #5 RDGS 24 JUN 88 10:34 SAMPLE RATE: 5 MINUTES
AI12 92.343 CF/HR AI14 987.15 GAL AI16 24500. GALS AI18 62.781 IN HG
PP30 12.944 IN HG PP31 23.451 CU FT PP32 512.21 C PP38 489.78 CU FT
AI11 1485.2 F AI13 763.52 C PP34 1897.7 F PP35 1336.5 DEG F
ALL ACTIVE ALARMS: AI103, PP42 , PP23 , AI18 , PP31 , PP30 , AI19 , PP33 , AI15 , AI99 ,
PP14 END

Figure 5-2
Typical Datalog Chart

5. Operation

TRENDVUE FEATURE

Because the printhead actually marks the chart paper on the top of the chart drive roller, the most recently printed information is not readily visible through the front window of the recorder. The Trendvue feature is for users who wish to view the most recent markings on trendlines as they are printed.

During the non-printing position of the recorder cycle, Trendvue holds the chart paper in an advanced position, so that the ends of trendlines are visible. Because printing occurs in short bursts, the latest trend data is visible most of the time. Typically, every thirty seconds or so, the chart paper will retract rapidly, trends will print for a few seconds, and then the chart paper will be rapidly advanced again where it will remain for another thirty (typically) seconds.

The actual time intervals for Trendvue sequencing depend on the volume of trend data being printed. The Trendvue feature is programmed to cancel if less than 20 seconds of rest time in the trendvue position is available. Trendvue will operate from 1 to 49 cm/hr. From 50 to 200 cm/hr, Trendvue will not operate.

To operate the Trendvue feature, press **CHART**. The display will show:

```
SELECT CHART FUNCTION

1-LO SPEED 25CM HR  2-HI SPEED 120CM HR  3-CHART FEED
4-OFF  5-TRENDVUE  6-TREND  7-DATALOG  8-RESUME DATALOG 9-QUIT
```

Press the numeral **5** key to select TRENDVUE. At the prompt, press numeral **1** to turn Trendvue ON, or numeral **2** to turn Trendvue OFF. All other Trendvue functions are automatic.

ZOOM FEATURE

The zoom feature allows you to temporarily expand a chosen portion of the chart scale to full chart width, for improved visibility. Trendlines of all data points having the same range and limits as a chosen reference data point will be magnified (other requirements apply – see Table 5-1). This feature is useful when many trendlines overlap on the chart and obscure individual readings. Note also that the zoom feature also affects the display. While zoom is in effect, the graphic scale on the bottom line of the display of a zoomed point will be magnified to correspond to the chart. The word "ZOOM" will appear on the left side.

TABLE 5-1
Zoom Point Requirements

In order to be "ZOOMED", a given point must match the configuration of the "ZOOM reference point" as follows:

Pseudo Point:
- must have the same low limit
- must have the same high limit
- must have the same function type (Scale, Select, etc.)

Analog Output:
- must have the same input low limit
- must have the same input high limit

Analog Input:
- must have the same left scale value
- must have the same right scale value
- must have the same range type
- must have the same temperature units (°C, F, R, K, or none)

Operate the zoom feature as follows:

1. Press the **ZOOM** key. The display will show:

```
 AI105 BOILER NO. 37 26.250 C
ZOOM
1-ZOOM POINT DISPLAYED  2-SELECT ZOOM REFERENCE POINT
3-UNZOOM 4-DISPLAY ZOOMED POINTS 5-QUIT
```

2. Select the reference data point to be zoomed (that point and others having the same configuration will be zoomed).

NOTE

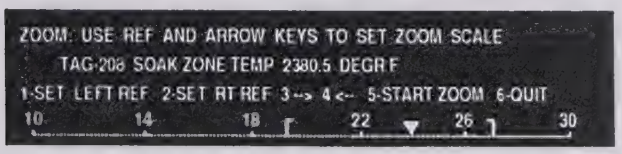
Only one zoom condition can exist at any one time in the SPEEDOMAX 25000. If another point is already zoomed, you must unzoom it first (see procedure below).

To select the point currently on the display as the reference point, press the numeral **1** key (ZOOM POINT DISPLAYED) and proceed to step 3. To select a different point as the reference point, instead of the one on the display, press the numeral **2** key.

If you press **2**, the display will show:

At the prompt, press numeral **1, 2,** or **3** key to select, respectively, AI, PP, or AO for your data point type. The display will show:

Key in the number of the data point and press **ENTER**. The data point is now selected. The display will change to the following:

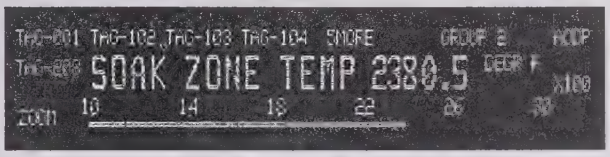

ZOOM: USE REF AND ARROW KEYS TO SET ZOOM SCALE
TAG-208 SOAK ZONE TEMP 2380.5 DEGR F
1-SET LEFT REF 2-SET RT REF 3 --> 4 <-- 5-START ZOOM 6-QUIT
10 14 18 22 26 30

3. Use this display to set the left and right boundaries of the portion of the scale you wish to magnify, as follows:

a. Press numeral **1** key to select SET LEFT REF. Using numeral **3** key for left cursor action and numeral **4** key for right cursor action, position the left indicator where desired on the scale.

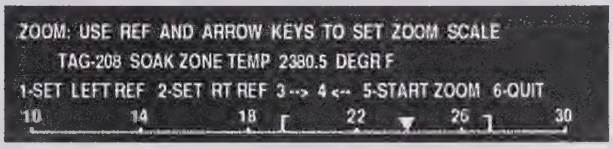
b. Press numeral **2** key to select SET RT REF. Using the numeral **3** key and **4** key as above, position the right hand indicator where desired to mark the right edge of the scale.

4. Press the numeral **5** key to begin zoom. The display will expand. A typical example:



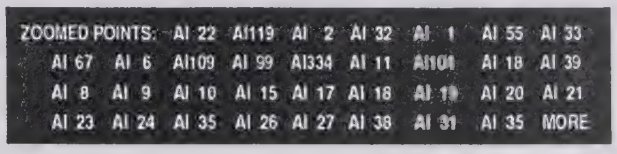
All points having the same configuration (see Table 5-1) as the reference point will be zoomed.

5. To change or review the zoom settings for the selected points, press **ZOOM** and numeral **1** to show the point currently displayed, or numeral **2** to select another point. When the point is selected, this display will appear, on which you may set left and right limits as previously described:


ZOOM: USE REF AND ARROW KEYS TO SET ZOOM SCALE
TAG-208 SOAK ZONE TEMP 2380.5 DEGR F
1-SET LEFT REF 2-SET RT REF 3 --> 4 <-- 5-START ZOOM 6-QUIT
10 14 18 22 26 30

6. To zoom a different point, you must first "unzoom" the zoomed points by pressing **ZOOM**, followed by numeral **3** key (UNZOOM). Then specify a new zoom according to the previous instructions.

7. To see a display of all the points currently in zoom condition at any time, press **ZOOM** and then press the numeral **4** key to select DISPLAY ZOOMED POINTS. The display will show a list of all points in ZOOM, as in this example:


ZOOMED POINTS: AI 22 AI119 AI 2 AI 32 AI 1 AI 55 AI 33
AI 67 AI 6 AI109 AI 99 AI334 AI 11 AI101 AI 18 AI 39
AI 8 AI 9 AI 10 AI 15 AI 17 AI 18 AI 19 AI 20 AI 21
AI 23 AI 24 AI 35 AI 26 AI 27 AI 38 AI 31 AI 35 MORE

If MORE appears on the display, press the **MORE** key to see additional points in **ZOOM**.

Press the **CLEAR/ESC** key to restore the display to the function interrupted when **ZOOM** was pressed.

5. Operation

POINT HOLD FEATURE

With this feature, you may isolate a single point for monitoring on the chart, on the display, or on both.

1. Press **POINT HLD/REL**. The display will show:

```
   AI105  BOILER NO. 37  26.250 C
POINT HOLD
SELECT:
1-DISPLAY 2-CHART 3-DISPLAY AND CHART 4-QUIT
```

2. Press the numeral **1, 2**, or **3** key to hold the point, respectively, on the display only, chart only, or both display and chart. (Discrete data points can be held only on the display.) Chart Hold will produce a single point trend. The display will show the single point, as in this example:

```
   AI105  BOILER NO. 37  26.250 C
POINT HOLD
POINT SELECT: CHOOSE POINT DISPLAYED OR ANOTHER POINT
1-POINT DISPLAYED 2-AI 3-PP 4-AO 5-DI 6-DO 7-PD
```

3. Press the numeral **1** key to select the point currently displayed (AI105 on the example display). To select another point, press any of the other designated keys in the prompt on the message line and then key in the numbers of the points at the following prompt and press **ENTER**. Point hold will begin immediately. While in point hold, a message will appear at the left of the display as illustrated in this example:

The HOLD message is a reminder to the operator that while a point hold is in effect, other programmed operations, such as trending and datalogging might be being interrupted. The HOLD message does not appear for a point in Chart Hold only.

4. To release (cancel) the point hold feature, press the **POINT HLD/ REL** key.

SUMMARIES

Use the **SUMMARY** key to print various types of data summaries across the full width of the chart (except for the right margin). These printouts will interrupt trending, datalogging, or other functions in process and restore those functions automatically when the summary printouts are complete (or cancelled).

Press the **SUMMARY** key. The display then lists the available choices of summaries:

```
PRINT SUMMARIES

1-ACTIVE ALARMS 2-ALARM HISTORY 3-ANALOG 4-DISCRETE
5-ALL DATA 7-DIAG. SUMMARY 8-STOP PRINT 9-QUIT
```

See Figure 5-3 for examples of printed summaries.

Each selection will start printout of the specified type of data. Additional keyed requests will be queued. Selecting another summary will result in that summary being printed immediately following completion of the summary currently printing.

The summaries will print in the following colors: active alarms, red; alarm history, black; all data, black; diagnostics, blue.

To cancel all printouts, press the numeral **8** key. The display will return to the display interrupted when **SUMMARY** was pressed.

Use the Summary display as follows:

1. Pressing numeral **1** (Active Alarms), **2** (Alarm History), or **7** (Diagnostic Summary) will start printing immediately and return the display to what was displayed when **SUMMARY** was pressed. Pressing keys for any of the other selections will require further data entry, as described in the following steps.

2. Press numeral key **3** to select ANALOG SUMMARY. The display will show:

```
SELECT ANALOG SUMMARY

1-ANALOG GROUP (S) 2-ALL ANALOG GROUPS 3-ALL ANALOG POINTS
```

5. Operation

Example 1. "ALL DATA" Summary, Tag I.D.

```
ALL POINTS SUMMARY          24 JUN 88  13:44:31

AI  FY-276A  23.455 DEG/HR  LY-311   1.9087 IN HG  TG-05    0.0000 F      ZOT-789 4.3555 FT LBS
    TH-144   SKIPPED       FRC-418  184.77 CU FT  ---      132445 GALS   TT-908C 1960.3 C
    FAN-344  10.455 IN WC  H-T-124  156.07 F     PW-5921  23.455 C      HSG-112 SKIPPED
    LSL-101  934.50 F      FYG-102  48.555 CF OXY BAG-247  3.7082 GAL/HR

AO  BH-044   31.105 PCT 02 HOT-723  13.007 CU FT  PAW-421  0.0000 C      HKT-207 7.3535 C
    ITG 113  3.7091 DEG/HR BLR-019  16.477 AMPS

PP  TG-90J   28.050 BTU/HR TG-902   9.1077 KWH   TG-903   117.44 VOLTS  TG-904  2.2525 AMPS
    TG-905   4.8092 DEG/HR TG-906   19.127 CF/HR TG-907   0.0000 IN/HR  TG-908  88.183 FT/HR

CN  COMP-1   0.7455  COMP-2  1.0087        ---      0.0000  LX-814  3.3565  JAY-216  3.7073
    GTX-704  184.77  ---     0.0000        ABL-17   1.1123  MC-881  10.455  JUL-08   15.607
    PMC 031  23.334  ---     0.0000        ---      0.0000  ---     0.0000  ---      0.0000
    ---      0.0000  ---     0.0000        ---      0.0000  ---     0.0000  ---      0.0000
    ---      0.0000  ---     0.0000        ---      0.0000  ---     0.0000  ---      0.0000
    ---      0.0000  ---     0.0000        ---      0.0000  ---     0.0000  ---      0.0000
    ---      0.0000  ---     0.0000        ---      0.0000  ---     0.0000  ---      0.0000

DI  DSC-55   PWR ON  SW-071  AIR ON        TOG-4    INCR    DMP-9   SHUT    SW-16    OFF
    TOG-8    ON      LEV-28  EMPTY         FLAP-9   OPEN    VALVE-2 CLOSED  LEV-29   FULL
    LOC-33   ZONE 1  LOC-34  ZONE 2        LOC-35   ZONE3   SENS-89 HOT     EVENT-5  DONE

DO  VALVE-9  CLOSED  SW-77   SET           CTL-120  OFF     VENT-5  OPEN    SE-061   ON
    LC-100   DECR    LC-1018 SHIFT3        SWL-99   CLEAR   PDS-87  OFF     PAL-443  RESET

PD  LOGIC-1  ON      LOGIC-2 OFF           ATC-002  OFI     DLC-019 ON
```

Example 2. "ALL DATA" Summary, Point Number I.D.

```
ALL  POINTS  SUMMARY  24 JUN 88      13:44:31

AI   23.455 DEG/HR     AI2 1.9087 IN HG      AI3  0.0000 F        AI4  4.3555 FT LBS
AI5  SKIPPED           AI6 184.77 CU FT      AI7  132445 GALS     AI8  1960.3 C
AI9  10.455 IN WC      AI10 156.07 F         AI11 23.455 C        AI12 SKIPPED
AI13 934.50 F          AI14 48.555 CF OXY    AI15 3.7082 GAL/HR

AO1  31.105 PCT 02     AO2 13.007 CU FT      AO3  0.0000 C        AO4  7.3535 C
AO5  3.7091 DEG/HR     AO6 16.477  AMPS

PP   28.050 BTU/HR     PP2 9.1077  KWH       PP3  117.44  VOLTS   PP4  2.2525  AMPS
PP   4.8092 DEG/HR     PP6 19.127  CF/HR     PP7  0.0000  IN/HR   PP8  88.183  FT/HR

CN13 0.7455  CN22  1.0087    CN29  0.0000      CN41  3.3565    CN61  3.7073
CN15 184.77  CN23  0.0000    CN29  1.1123      CN42  10.455    CN62  15.607
CN17 23.334  CN24  0.0000    CN30  0.0000      CN43  0.0000    CN63  0.0000
CN18 0.0000  CN25  0.0000    CN31  0.0000      CN44  0.0000    CN64  0.0000
CN19 0.0000  CN26  0.0000    CN32  0.0000      CN45  0.0000    CN65  0.0000
CN20 0.0000  CN27  0.0000    CN33  0.0000      CN46  0.0000    CN66  0.0000
CN55 0.0000  CN28  0.0000    CN34  0.0000      CN46  0.0000    CN67  0.0000

DI12  PWR ON DI52  AIR ON    DI15  INCR        DIB6  SHUT      DI99  OFF
DI13  ON     DI53  EMPTY     DI16  OPEN        DIB8  CLOSED    DI98  FULL
DI14  ZONE1  DI51  ZONE2     DI17  ZONE3       DIB7  HOT       DI97  DONE

DO1  CLOSED  DO2  SET        DO7 OFF           DO3  OPEN      DO9  ON
DO6  DECR    DO5  SHIFTS     DO3 CLEAR         DO12 OFF       DO10 RESET

PD9 ON       PD10  OFF       PD11 OFF     PD12  ON
```

Figure 5-3
Examples of Summary Printouts

Press numeral **3** key to begin immediate printing of all analog points and to restore the display to what was interrupted when **SUMMARY** was pressed. Press the numeral **2** key to print all analog points that have been included in groups.

Press the numeral **1** key to print analog summary data by selected groups. The display will show:

```
SELECT ONE OR MORE GROUPS
ENTER GROUP NUMBERS (1-20):
 8  6  17  4  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
+/- TO MOVE CURSOR                          ENTER WHEN DONE
```

Key in each group number, then press the **+/–** key to advance the cursor to the right. A zero will appear where a group number has not been assigned. A maximum of 20 selections (numbers or zeros) is available. After entering the last group, press **ENTER** to start summary printing. The display interrupted when **SUMMARY** was pressed will be restored.

3. Press numeral **4** key to select DISCRETE SUMMARY. The display will show:

```
SELECT DISCRETE SUMMARY

1-DISCRETE GROUP (S) 2-ALL DISCRETE GROUPS 3-ALL DISCRETE POINTS
```

Press numeral **3** key to begin immediate printing of all discrete data points and to restore the display which was interrupted when **SUMMARY** was pressed. Press numeral **2** key to print all discrete points that have been included in groups.

Press the numeral **1** key to print discrete summary data by selected groups. The display will show:

```
SELECT ONE OR MORE GROUPS
ENTER GROUP NUMBERS (1-20):
 8  6  17  4  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
+/- TO MOVE CURSOR                          ENTER WHEN DONE
```

Key in each group number, then press the **+/–** key to advance the cursor to the right. After entering the last group, press **ENTER** to start summary printing. The display which was interrupted when **SUMMARY** was pressed will be restored.

4. Press numeral **5** key to select ALL DATA SUMMARY. The display will show:

```
SELECT ALL DATA SUMMARY

1-ALL GROUPS  2-ALL POINTS
```

ALL GROUPS will only print out data assigned to groups. This will be printed out by group.

ALL POINTS will print data by point type, including all constants (Fig. 5-3).

EVENT MARKERS

The ability to print discrete event markers on charts is an important feature of the SPEEDOMAX 25000. Event markers are set up by user programming, using procedures explained in Section 6, Programming. The technique employed is to create a pseudo point using the SIGNAL SELECT function. The pseudo point will have one value when the discrete data point (event) is ON and another value when the discrete point is OFF. The trend chart of the pseudo point then becomes an event marker. An example of a typical event marker on a SPEEDOMAX 25000 chart is shown in Figure 5-4.

5. Operation

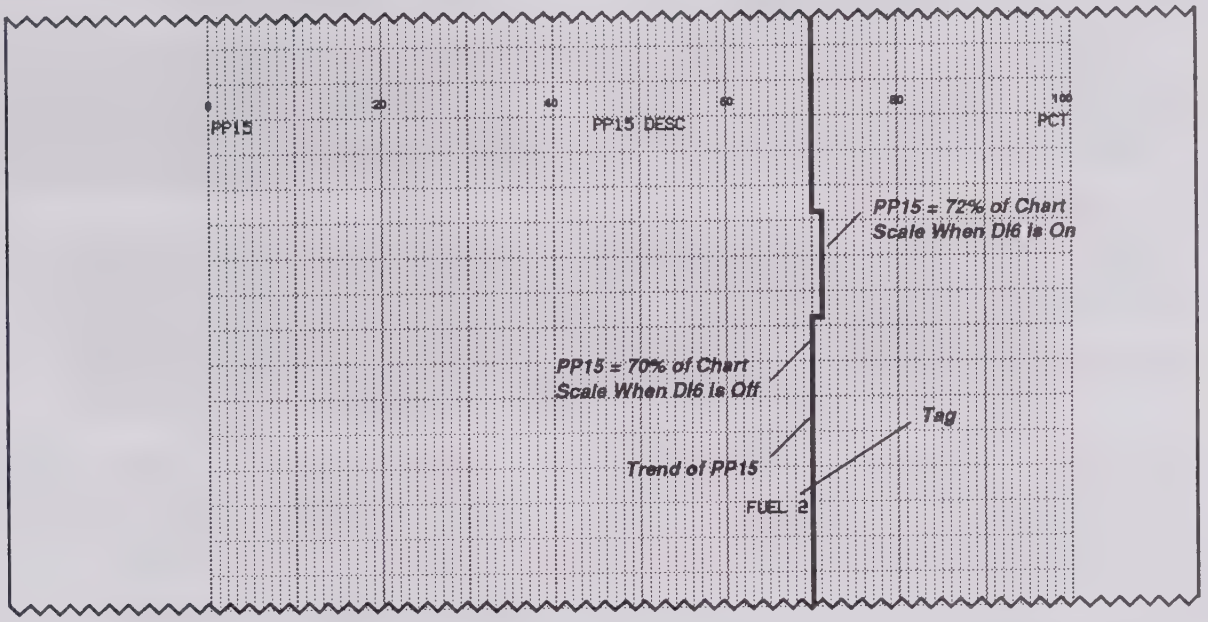


Figure 5-4
Typical Event Marker on Chart

DISPLAY OPERATING PROCEDURES

Operation of the display is independent of chart operation. The display may be used to view data in a number of formats without any influence on chart activities which are occurring simultaneously.

This section describes procedures for selecting a display format, specifying the data to be displayed, and instructions and suggestions for use of special features which will make displays more useful.

DISPLAY FORMAT

Data may be displayed a single point at a time or several points at a time (Fig. 5-5). Multiple points or groups of points may be displayed sequentially with each point (or several points) displayed for a short period of time and then followed by the next. Set these items as follows:

1. Press the **DISPLAY** key. The display will show:

```
SELECT DISPLAY

1-ALL POINTS 2-SINGLE GROUPS 3-MULTIPLE GROUPS 4-ALL ANALOG
5-ALL DISCRETE 6-FORMAT 7-TIME PER DISPLAY 8-QUIT
```

Press the numeral **6** key to select FORMAT. The display will show:

```
SELECT DISPLAY FORMAT
0-SML. PTR. DESC. ALM 1-NARROW BAR DESC. ALM 2-LRG. PTR. DESC.
3-WIDE BAR DESC. 4-SML. PTR. PT/TAG ALM 5-NAR. BAR PT/TAG ALM
6-LAR. PTR. PT/TAG 7-WIDE BAR PT/TAG 8-MULTIPOINT 9-QUIT
```

The format selections for the display which are listed here are illustrated in Figure 5-6. Press the numeral key corresponding to the desired type of format. If you make no selection, the default format will be Format 0.

When you press the numeral key, the display will change immediately to presentation of data in the selected format. The actual data on the display will depend on previous selections or default programming. Press the **DISPLAY** key to restore the display shown in step 1.

2. Press the numeral **7** key to select TIME PER DISPLAY. The display will show:

```
TIME PER DISPLAY

ENTER TIME PER DISPLAY (SECONDS): 3
```

Key in the desired time, in seconds (1-60), for each display to be shown before changing to the next data item. Press **ENTER**. The display will change immediately to presentation of data in the selected format and the selected time per display. Proceed to the next step, which is selecting data to be displayed.

NOTE

The display format and time per display settings do not have to be set each time you use the display. The settings selected will remain the same until you change them, using the preceding procedures.

SELECT DATA FOR DISPLAY

To select data for the display, press **DISPLAY**. The display will show:

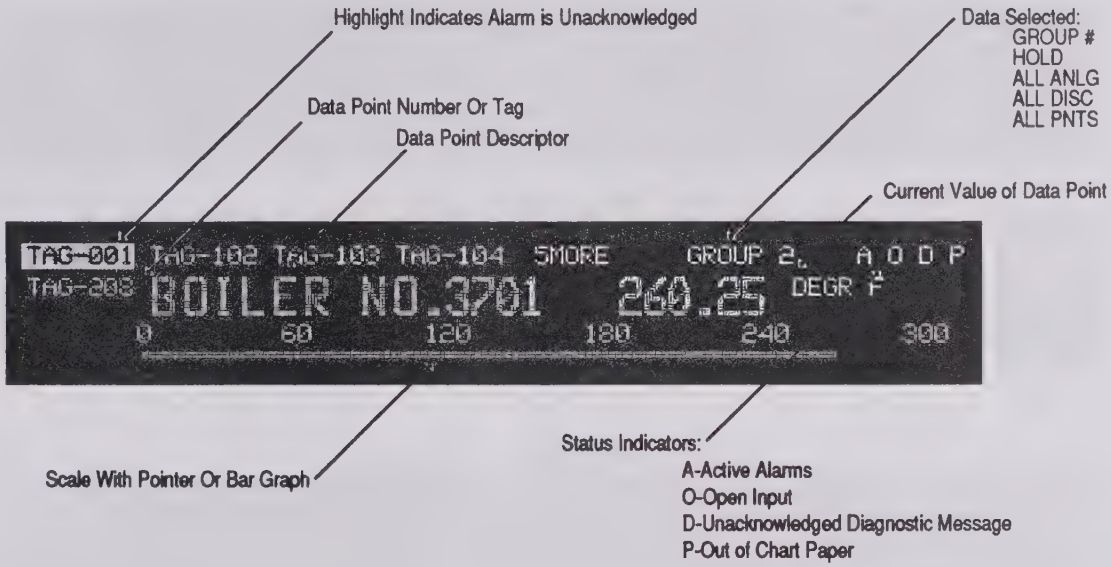
```
SELECT DISPLAY

1-ALL POINTS 2-SINGLE GROUP 3-MULTIPLE GROUPS 4-ALL ANALOG
5-ALL DISCRETE 6-FORMAT 7-TIME PER DISPLAY 8-QUIT
```

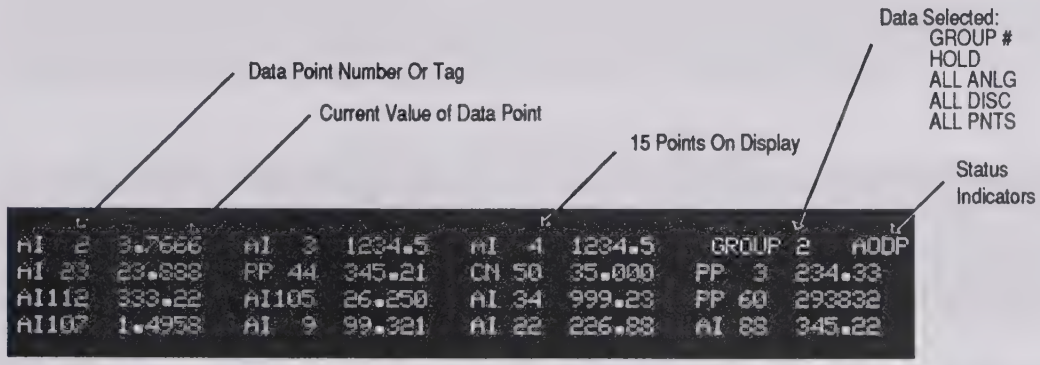
Press numeral keys **1, 4,** or **5** to start immediate sequential display of all data points, all analog, or all discrete points, respectively.

Press the numeral **2** key to select a single group. The display will change to a prompt to enter the group number. Key in the number and press **ENTER** to immediately start the display.

Press the numeral **3** key to select multiple groups. The display will prompt for the group numbers. Key in each number, then press the **+/–** key to move the cursor to the right. After the last entry, press **ENTER** to start the display.



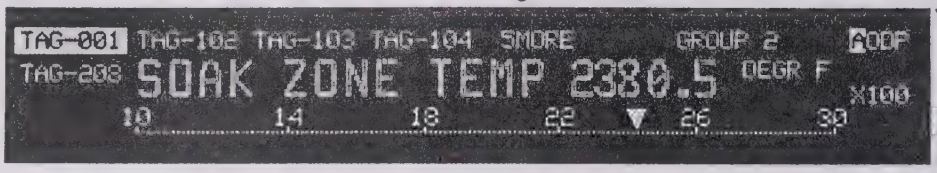
Example Of A Single Point Data Display


Data Selected:
GROUP #
HOLD
ALL ANLG
ALL DISC
ALL PNTS
Data Point Number Or Tag
Current Value of Data Point
15 Points On Display
Status Indicators
AI 2 3.7666 AI 3 1234.5 AI 4 1234.5 GROUP 2 ADDP
AI 23 23.888 PP 44 345.21 CN 50 35.000 PP 3 234.33
AI112 333.22 AI105 26.250 AI 34 999.23 PP 60 293832
AI107 1.4958 AI 9 99.321 AI 22 226.88 AI 88 345.22

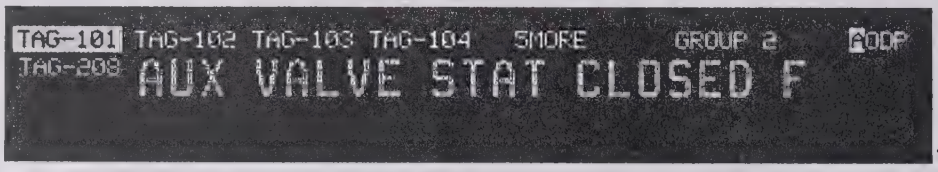
Example Of A Multiple Point Data Display

Figure 5-5

Format 0-Analog Point

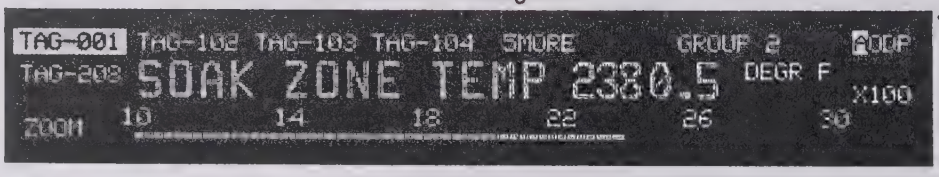


Format 0-Discrete Point

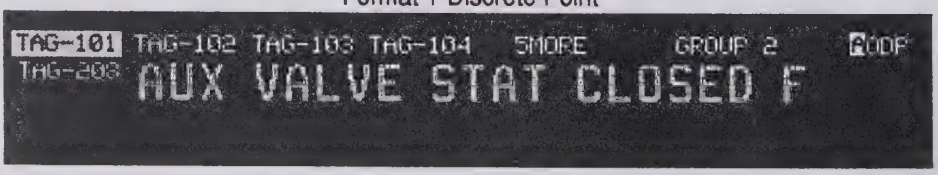


Format 0
- Alarm Line
- Single Point Descriptor I.D.
- Scale With Pointer

Format 1-Analog Point

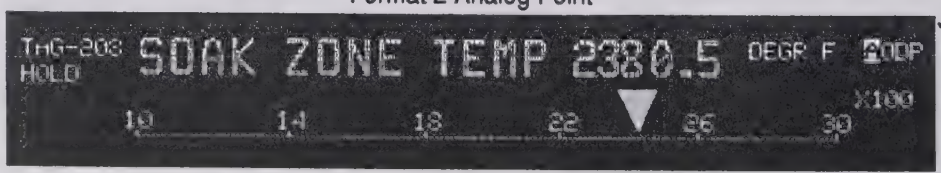


Format 1-Discrete Point

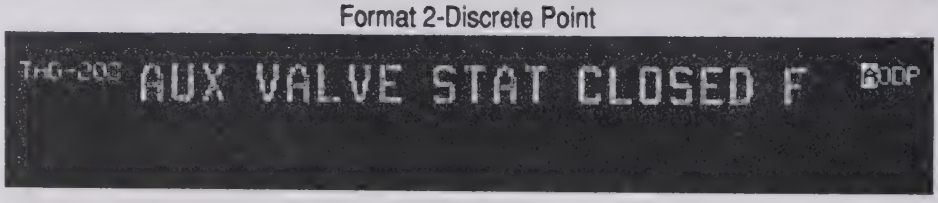


Format 1
- Alarm Line
- Single Point Descriptor
- Scale With Bar Graph

Format 2-Analog Point



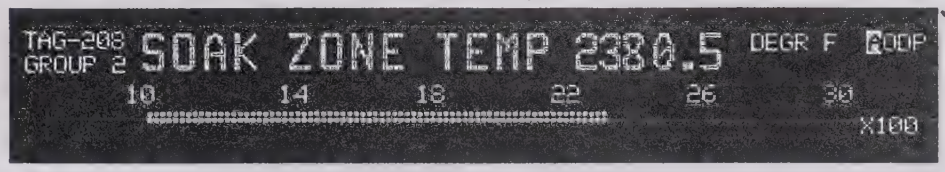
Format 2-Discrete Point



Format 2
- Single Point Descriptor I.D.
- Scale With Large Pointer

Figure 5-6
Display Formats

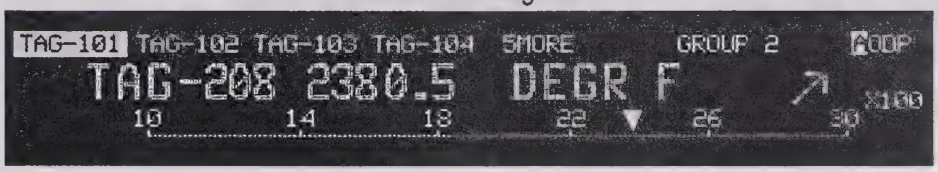
Format 3-Analog Point



Format 3-Discrete Point

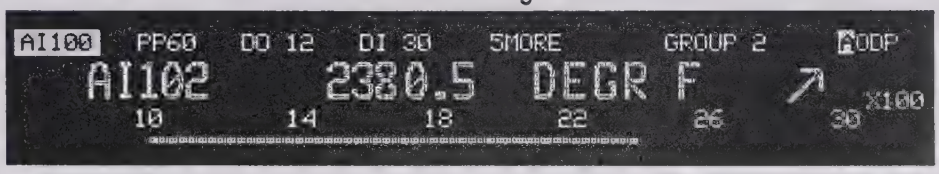
Format 3
- Single Point Descriptor I.D.
- Scale With Large Bar Graph

Format 4-Analog Point



Format 4
- Alarm Line
- Single Point Tag I.D. or Point Number I.D.
- Scale With Pointer
- Rate Indicator

Format 5-Analog Point



Format 5
- Alarm Line
- Single Point Tag I.D. or Point Number I.D.
- Scale With Bar Graph
- Rate Indicator

Format 6-Analog Point

Format 6
- Alarm Line
- Single Point Tag I.D. or Point Number I.D.
- Scale With Large Pointer
- Rate Indicator

Format 7-Analog Point

Format 7
- Single Point Tag I.D. or Point Number I.D.
- Scale With Large Bar Graph
- Rate Indicator

Figure 5-6 (con't)
Display Formats

Format 8-Analog Points, Tag I.D.

```
TAG-991 3.7666  TAG-992 1234.5  TAG 993 1234.5    GROUP 2   AODP
TAG-001 1234.5  TAG-002 1234.5  TAG-003 1234.5  TAG-004 1234.5
TAG-101 5.7669  TAG-102 1234.5  TAG 103 1234.5  TAG 104 1234.5
TAG-201 1234.5  TAG-202 1234.5  TAG-203 1234.5  TAG-204 1234.5
```

Format 8-Analog Points, Point Number I.D.

```
AI2    3.7666   AI3    1234.5   AI4    1234.5    GROUP 2   AODP
AI23   23.888   PP44   345.21   CN50   35.000    PP3    234.33
AI112  333.22   AI105  26.250   AI34   999.23    PP60   293832
AI107  1.4958   AI  9  99.321   AI 22  226.88    AI 88  345.22
```

Format 8-Discrete Points, Point Number I.D.

```
PD2    ON       PD3    OFF      PD4    OFF      GROUP 2   AODP
DI23   OPEN     DI44   CLOSED   DO50   OFF    DO3    ON
DI112  OPEN     DI105  CLOSED   DI34   OFF    DO60   ON
DO107  CLOSED   DI  9  OFF      DI 22  ON     DO 88  OFF
```

Format 8-Discrete Points, Tag I.D.

```
TAG-991 ON      TAG-992 OFF     TAG 993 OFF      GROUP 2   AODP
TAG-001 OPEN    TAG-002 CLOSED  TAG-003 OFF      TAG-004 ON
TAG-101 OPEN    TAG-102 CLOSED  TAG 103 OFF      TAG 104 ON
TAG-201 CLOSED  TAG-202 OFF     TAG-203 ON       TAG-204 OFF
```

Format 8

- 15 Points Displayed Simultaneously
- Tag or Point Number I.D.

Figure 5-6 (con't)
Display Formats

LAST DISPLAY KEY

Press this key to restore the previous display. It is provided as a convenience to the operator and is especially useful for comparing two different displays. Pressing this key repeatedly will alternate between two on-line displays.

MORE KEY

This key is active only when the prompt MORE appears on the display, which indicates that more data is present than will fit in the limited display space. Press **MORE** to see the additional data. For large data items, it may be necessary to press **MORE** several times to view all the data.

POINT HOLD FEATURE

With this feature, a single point may be isolated for continuous monitoring on the display, the chart, or both. The use of this feature is described fully in the previous instructions for use of chart functions. See "Point Hold Features" in the "Chart Operating Instructions" section.

ZOOM FEATURE

This feature magnifies the chart and display scales of selected points for closer observation. See "Zoom Feature" in the "Chart Operating Instructions" section for complete information.

OTHER FUNCTIONS

The display is the primary element in the use of several functions which are described in other sections. These include review of alarms and diagnostics, changing setpoints and other values, and calibration. See "Alarms" and "Special Functions" sections for more information.

ALARMS

Whenever an alarm is activated or cleared, it is noted on the right chart margin (Fig. 5-1). Whenever an alarm is active, the letter "A" will appear in the upper right corner of the display. As shown in Figure 5-7, the letters O, D and P will also appear to indicate an open input, an unacknowledged diagnostic message, or the need for chart paper, respectively.

If display formats 0, 1, 4 or 5 are in use, active alarms will be listed on the top line of the display (Fig. 5-7). The **ACKNOWLEDGE** key will scroll the alarm display from right to left as each alarm is acknowledged. When all active alarms are acknowledged, the **MORE** key will allow review of all alarms when there are more than will fit on a single display (the **MORE** key is not active unless all alarms are acknowledged). Presentation of alarm data on these displays is as follows:

- Unacknowledged alarms appear highlighted in reverse video. Acknowledged active alarms appear in normal video.
- Cleared alarms will not be listed on the display.
- Alarms will be cleared without being acknowledged if the alarm condition no longer exists
- Unacknowledged alarms are displayed first, followed by acknowledged alarms. Within each category (unacknowledged or acknowledged), the oldest will be listed first, followed by the next oldest, etc.

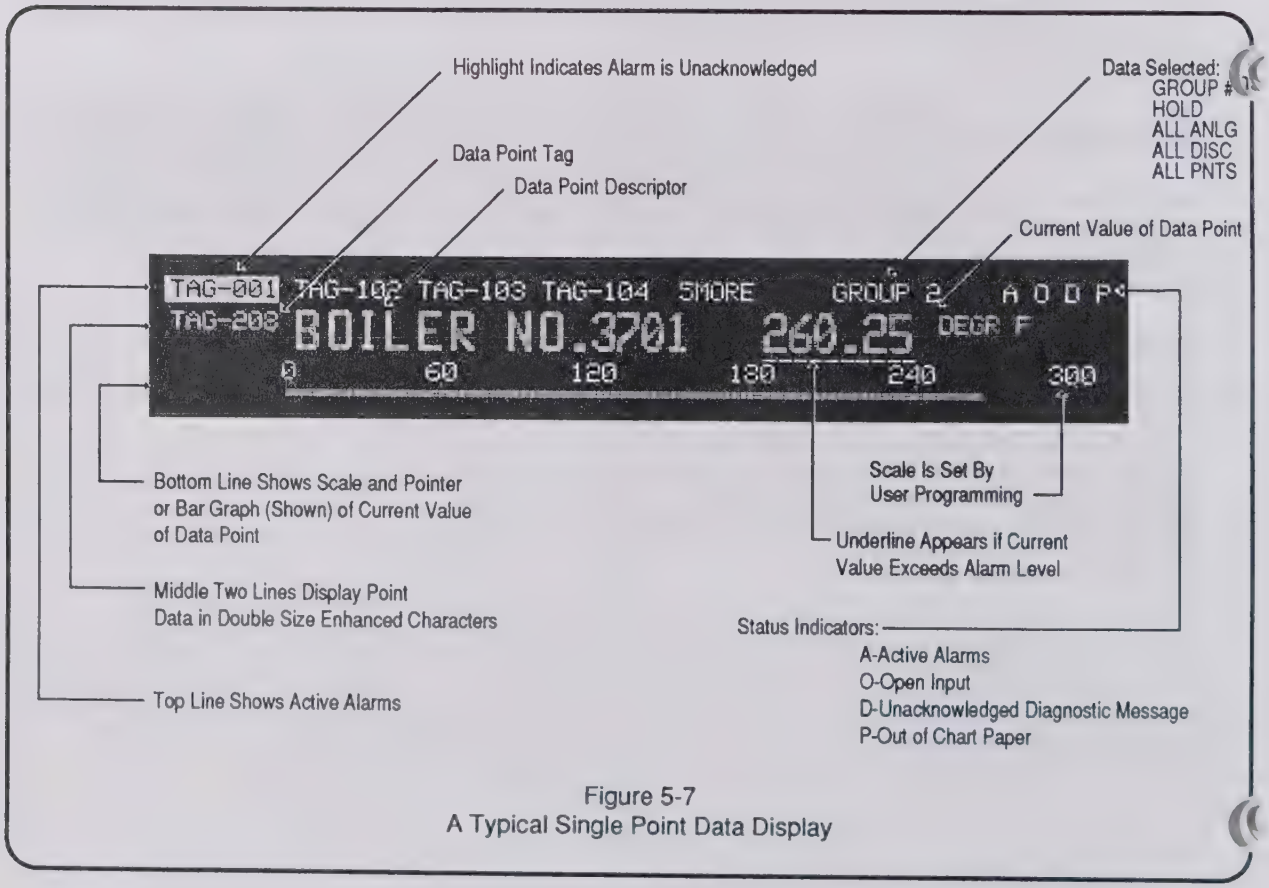

Highlight Indicates Alarm is Unacknowledged
Data Selected:
GROUP #
HOLD
ALL ANLG
ALL DISC
ALL PNTS
Data Point Tag
Data Point Descriptor
Current Value of Data Point
TAG-001 TAG-102 TAG-103 TAG-104 5MORE GROUP 2 A O D P
TAG-208 BOILER NO.3701 260.25 DEGR F
0 60 120 180 240 300
Bottom Line Shows Scale and Pointer or Bar Graph (Shown) of Current Value of Data Point
Middle Two Lines Display Point Data in Double Size Enhanced Characters
Top Line Shows Active Alarms
Scale Is Set By User Programming
Underline Appears if Current Value Exceeds Alarm Level
Status Indicators:
A-Active Alarms
O-Open Input
D-Unacknowledged Diagnostic Message
P-Out of Chart Paper

Figure 5-7
A Typical Single Point Data Display

ACKNOWLEDGE AND REVIEW ALARMS

Alarms may be acknowledged and reviewed on the display without disturbing any chart operations.

Press the **ACKNOWLEDGE** key to acknowledge the alarm. The display will show the alarm point data as illustrated in the example of Figure 5-8. Note that the alarm set point is indicated on the display scale (for unlinked alarms).

Press the **ACKNOWLEDGE** key again to acknowledge the next unacknowledged alarm. Acknowledged alarms will remain on the display in regular video (Fig. 5-8) and unacknowledged alarms will appear in reverse video.

When all alarms are acknowledged, and if no diagnostic messages are indicated, pressing the **ACKNOWLEDGE** key will display detailed information on the first active acknowledged alarm, as shown in Fig. 5-8.

Pressing the **ACKNOWLEDGE** key again will display information for the second active alarm, and so forth. This feature may be used to review the current status of each alarm. Chart operations will not be affected by these procedures.

When all active alarms have been acknowledged and, if diagnostic messages are present (D indicator on top line), pressing **ACKNOWLEDGE** again will cause diagnostic messages to be displayed, in "three-at-a-time" format, as shown in Figure 5-9. Press the **CLEAR/ESC** key to return to the interrupted display.

If you wish to again review active alarm status as described, you must acknowledge all diagnostic messages first.

To review all diagnostic messages, use the **SPECIAL FUNCTIONS** key. See "Diagnostic Messages" in the Special Functions section which follows this section for instructions.

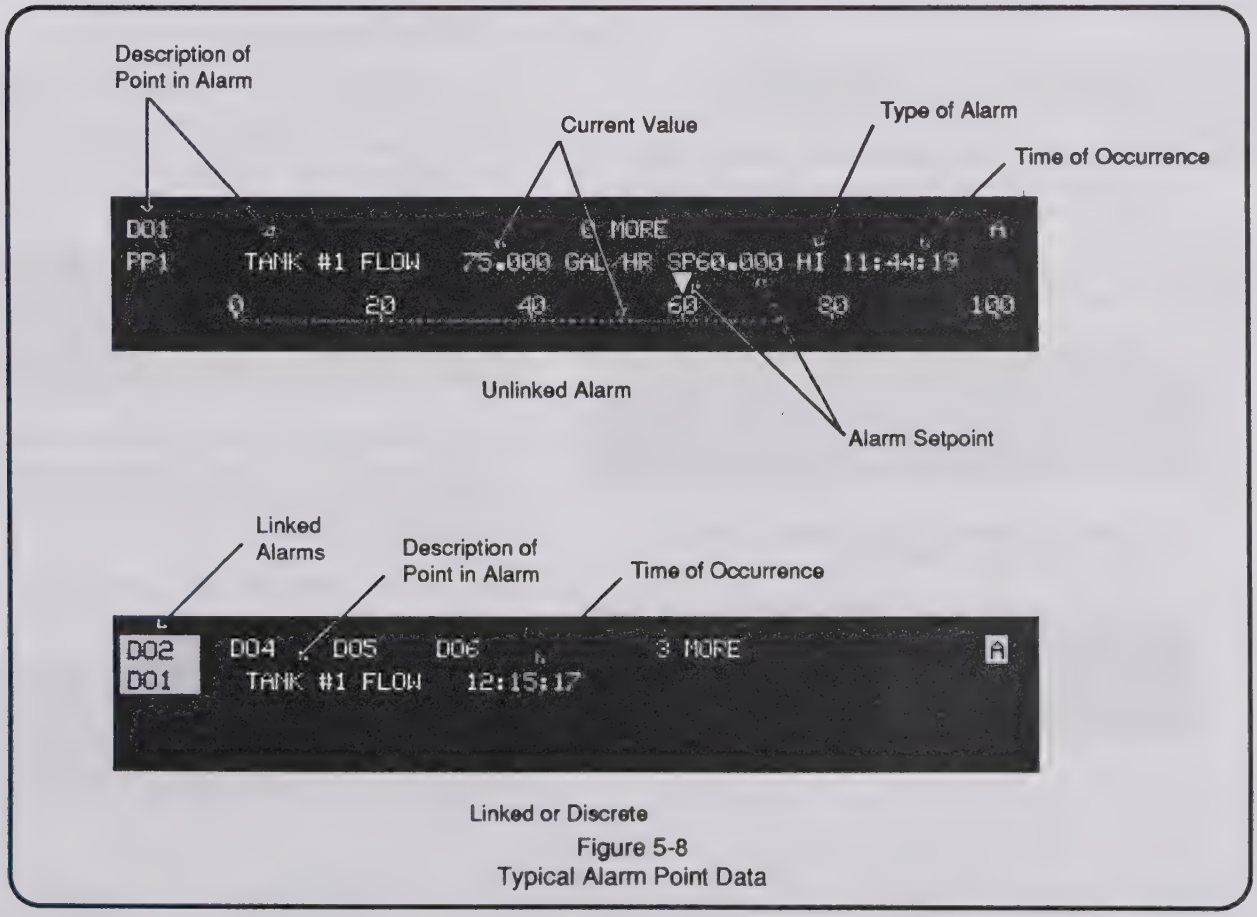


Figure 5-8
Typical Alarm Point Data

5. Operation

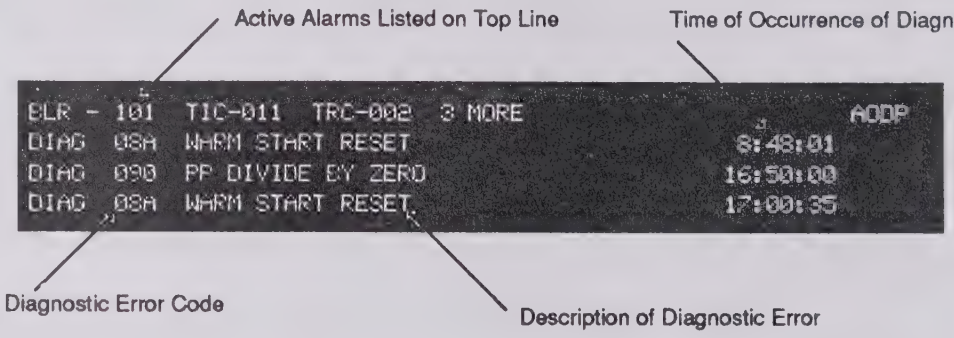

Active Alarms Listed on Top Line
Time of Occurrence of Diagnostic
BLR - 101 TIC-011 TRC-002 3 MORE
DIAG 08A WARM START RESET
DIAG 090 PP DIVIDE BY ZERO
DIAG 08A WARM START RESET
Diagnostic Error Code
Description of Diagnostic Error

Figure 5-9
Diagnostic Messages

CHANGING ALARM SETPOINTS

Alarm setpoints may be reviewed on the display and also may be changed, if the operator's security code is entered. Proceed as follows:

1. Press the **SPECIAL FUNCTIONS** key. The display will show:

SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT

2. Press the numeral **5** key to select ALARM SETPOINTS. The display will show:

3. If security is not available, press **ENTER**. If security is active, key in the security code and press **ENTER**. If you do not enter the code, press **ENTER** to view the alarm setpoints without the ability to change them. The display will show the alarm levels, as in this example:

4. Use the cursor (1, 2, 3 and 4) keys (and the **MORE** key, if necessary) to highlight the alarm level you wish to change. You may also use the FIND feature to locate the desired alarm level, as follows:

a. Press numeral **6** key to select FIND. The display will show:

b. Key in the desired alarm level number and press **ENTER**. The display will again show a list of alarm levels and the desired one will be highlighted, ready for change.

5. Press the numeral **5** key to select CHANGE ALARM SET PT. At the prompt, key in the new setpoint value and press **ENTER**. The alarm level list display will return. To change another setpoint, use the cursor keys or FIND feature as previously described.

NOTE

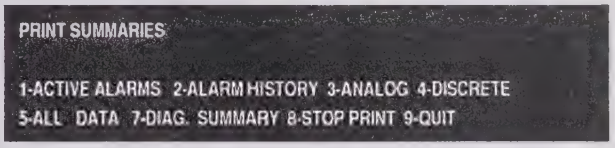
Only alarm setpoints configured as direct numerical entries can be changed. An alarm setpoint based on a measured value or a calculated value (such as AL2 or AL3 in the example above) cannot be changed on this display. To change such values, refer to the Programming section. When the cursor highlights such a value on this display, the message 5 – CHANGE ALARM SET PT will not appear.

6. Press the numeral **7** key to exit this function and return to the display interrupted when **SPECIAL FUNCTIONS** was pressed.

ALARM SUMMARY REPORTS

A list of active alarms or an alarm history report (Fig 5-10) may be printed on demand by means of the **SUMMARY** key. Proceed as follows:

1. Press the **SUMMARY** key. The display will show:



2. Press the numeral **1** or **2** key to select an Active Alarm Summary or an Alarm History Summary (Fig 5-10). The summary will print immediately, interrupting any chart operation in progress. If you wish to stop printing before the summary is complete, press the numeral 8 key to select STOP PRINT. When completed or stopped, the display and chart will return to what was interrupted when **SUMMARY** was pressed.

The SPEEDOMAX 25000 allocates sufficient memory to record a maximum of 100 alarms (50 active and 50 inactive) in an alarm summary. As an alarm condition is corrected, it converts from an active to an inactive alarm on the summary list.

If 50 active alarms are present, an additional alarm will not be added to the history. If 50 inactive alarms are present, an addition to the list will cause the oldest inactive alarm to be dropped from the list.

Alarm Summary Report Formats:

```
UNLINKED ALARM

  PT ID        TAG       SET PT    DO #      DO DESC      TIME IN   TIME OUT

  AI101      TIC-901   SP120.00    D05    BOILER TEMP 1  12:86:13  12:86:13

DISCRETE ALARM

                                   EI#
                         TAG       /DO#     DI/DO DESC   TIME IN   TIME OUT

                       SIC-823     DI2    BOILER ZONE A  12:26:13  12:27:55

LINKED ALARM

                         TAG       DO#       DO DESC     TIME IN   TIME OUT

                       HIC-213     D08    OVEN OVERHEAT  12:28:18  12:56:20
```

Examples of Alarm Summary Reports

```
ACTIVE ALARM SUMMARY          24 JUN 88        10:05:35
        AI101    TIC-901  SP120.00 D05    BOILER TEMP 1    12:26:13
                          SIC-823  DI2    BOILER ZONE A    12:26:13
                          HIC-213  D08    LAST VAT         12:28:18
        AI105    TIC-925  SP215.00 D03    BOILER PRES 4     2:26:13
        AI104    TIC-974  SP450.00 D02    BOILER TEMP 4     2:26:13
        AI103    TIC-603  SP100.00 D09    FUEL FLOW 3       2:26:13
                          SIC-823  DI3    BOILER ZONE A     3:26:13
                          HIC-213  D07    LAST VAT          3:30:18

HISTORICAL ALARM SUMMARY:     24 JUN 88   10:05:35
        AI101    TIC-901  SP120.00 D05    BOILER TEMP 1    12:26:13    12:26:25
                          SIC-823  DI2    BOILER ZONE 2    12:26:13    12:27:55
                          HIC 213  D08    LAST VAT         12:28:18    12:56:20
        AI105    TIC-925  SP215.00 D03    BOILER PRES 4     2:26:13     1:06:35
        AI104    TIC-974  SP450.00 D02    BOILER TEMP 4     2:26:13     1:16:15
        AI103    TIC-603  SP100.00 D09    FUEL FLOW 3       2:26:13     2:26:25
                          SIC-823  DI3    BOILER ZONE A     3:26:13     3:34:19
                          HIC-213  D02    LAST VAT          3:30:18     3:37:55
```

ACTIVE ALARM summaries and ALARM HISTORY summaries are identical with the exception that active alarms will not have an out time.

Note: *If an alarm point is reprogrammed while it is active, the out time will print 98:98:98.*

Figure 5-10
Alarm Summary Reports

5. Operation

SPECIAL FUNCTIONS

The following functions available to the operator are described in this section:

- Display date and time
- Forcing DI/DO changes
- Changing constant values
- Changing emissivity factors
- Handling diagnostic messages
- On-line calibration

DISPLAY DATE AND TIME

You may view the internal setting of the SPEEDOMAX 25000 clock/calendar at any time. To change the setting, see Section 8, Maintenance. Proceed as follows to view the settings:

1. Press the **SPECIAL FUNCTIONS** key. The display will show:

```
SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT
```

2. Press the numeral **1** key . The date and time will appear on the display and remain there until **ESC** is pressed.

FORCING DI/DO CHANGES

The current on/off status of discrete inputs and outputs may be reviewed on the display and may also be forced on or off, if the operator's security code is entered. Proceed as follows:

NOTE

Forcing these items will affect alarm or event actions. For example, if a DO is designated as an alarm and it is forced OFF, the alarm will not function.

1. Press the **SPECIAL FUNCTIONS** key. The display will show:

```
SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT
```

2. Press the numeral **4** key to select FORCE. The display will show:

```
FORCE

TO FORCE A DI / O < KEY IN SECURITY CODE AND PRESS ENTER : ....
TO VIEW ONLY PRESS ENTER
```

3. If security is not active, press **ENTER**. If security is active, key in the security code and press **ENTER**. If you do not enter the code, press **ENTER** to view the DIs and DOs without the ability to change them. The display will show the status of discrete inputs and outputs, as in this example:

```
DI 1 CLOSED  DI 2 CLOSED  DI 3 CLOSED  DI 4 CLOSED
DI 5 CLOSED  DI 6 CLOSED  DI 7 CLOSED  DI 8 CLOSED
DI 9 CLOSED  DI 10 CLOSED  DI 11 CLOSED  DI 12 CLOSED
1 <- 2 -> 3 ↑ 4 ↓ 5-FORCE / UNF. 6-ON 7-OFF 8-FIND 9-DONE MORE
```

4. Use the cursor (1, 2, 3 and 4) keys (and the **MORE** key, if necessary) to highlight the DI or DO you wish to force. You may also use the FIND feature to locate the desired DI or DO, as follows:

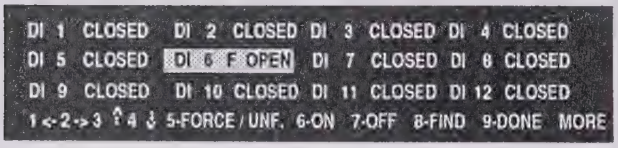
a. Press numeral **8** key to select FIND. The display will show:

```
FIND DISCRETE INPUT / OUTPUT

1-DI 2-DO
```

b. Press numeral **1** or **2** key to select DI or DO, respectively. Key in the desired DI or DO number at the prompt and press **ENTER**. The display will again show a list of DIs and DOs and the desired one will be highlighted, ready for change.

5. Press the numeral **5** key to select FORCE. Press the numeral **6** key or **7** key to force the DI or DO ON or OFF. There will be a delay while the Recorder makes the change and verifies it before updating the display. The display then will show a character F next to the DI or DO to indicate it is in a FORCED condition, as in this example:


DI 1 CLOSED DI 2 CLOSED DI 3 CLOSED DI 4 CLOSED
DI 5 CLOSED DI 6 F OPEN DI 7 CLOSED DI 8 CLOSED
DI 9 CLOSED DI 10 CLOSED DI 11 CLOSED DI 12 CLOSED
1<-2->3 ↑4 ↓ 5-FORCE / UNF. 6-ON 7-OFF 8-FIND 9-DONE MORE

You may press the numeral **9** key to return the display to the function interrupted when **SPECIAL FUNCTIONS** was pressed. The DI or DO will remain in that forced state until it is forced ON or OFF again by the **6** or **7** key on this display, or until the FORCE condition is removed. Remove the forced condition by pressing the numeral **5** key on the display to select "Unforce" (UNF). The F character will disappear from the display and the DI or DO will assume its natural state.

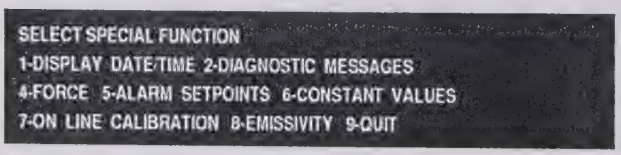
NOTE

The actual ON/OFF labels appearing on the display are determined by user programming (see Section 6). Default labels are ON/OFF, but could be changed to UP/DOWN, OPEN/CLOSED, or any other designations.

CHANGING CONSTANT VALUES

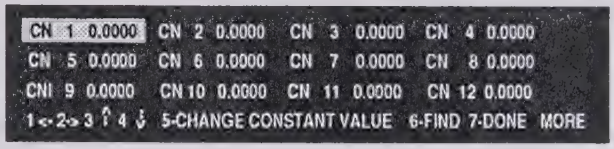
Mathematical constants are established by user programming (see Section 6). Constants may be reviewed on the display and also may be changed, if the operator's security code is entered. Proceed as follows:

1. Press the **SPECIAL FUNCTIONS** key. The display will show:


SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT

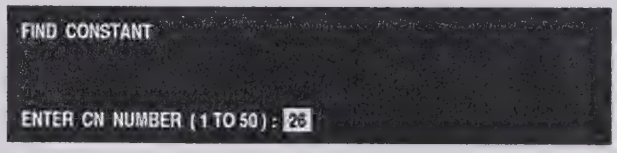
2. Press the numeral **6** key to select CONSTANT VALUES. The display will show:

3. If security is not active, press **ENTER**. If security is active, key in the security code and press **ENTER**. If security is active and you do not enter the code, press **ENTER** to view the constants without the ability to change them. The display will show the constants, as in this example:



4. Use the cursor (1, 2, 3 and 4) keys (and the **MORE** key if necessary) to highlight the constant you wish to change. You may also use the FIND feature to locate the desired constant, as follows:

a. Press the numeral **6** key to select FIND. The display will show:



b. Key in the desired constant number and press **ENTER**. The display will again show a list of constants and the desired one will be highlighted, ready for change.

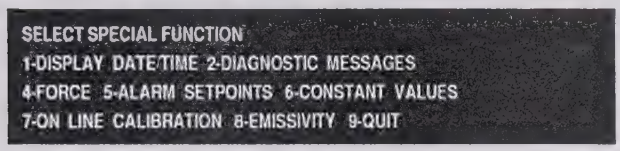
5. Press the numeral **5** key to select CHANGE CONSTANT VALUE. At the prompt, key in the new value and press **ENTER**. The constant list display will return. To change another constant value, use the cursor keys or FIND feature as previously described.

6. Press the numeral **7** key (DONE) to exit this function and return to the display interrupted when **SPECIAL FUNCTIONS** was pressed.

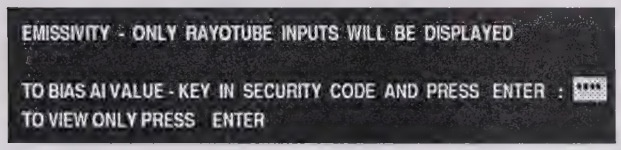
CHANGING EMISSIVITY FACTORS

Emissivity factors for Rayotube® radiation thermometers connected to the SPEEDOMAX 25000 may be reviewed and adjusted on the display if the operator's security code is entered. Proceed as follows:

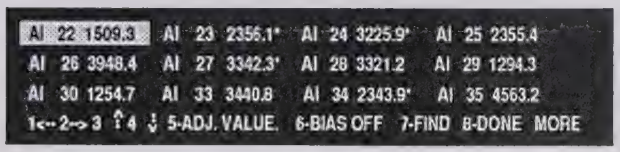
1. Press the **SPECIAL FUNCTIONS** key. The display will show:


SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT

2. Press the numeral **8** key to select EMISSIVITY. The display will show:


EMISSIVITY - ONLY RAYOTUBE INPUTS WILL BE DISPLAYED
TO BIAS AI VALUE - KEY IN SECURITY CODE AND PRESS ENTER :
TO VIEW ONLY PRESS ENTER

3. If security is not active, press **ENTER**. If security is active, key in the security code and press **ENTER**. If security is active and you do not enter the code, press **ENTER** to view the data without the ability to change it. The display will show all the Rayotube-measured temperatures, as in this example:



4. Use the cursor (1, 2, 3 and 4) keys (and the **MORE** key, if necessary) to highlight the value you wish to change. You may also use the FIND feature to locate the desired Rayotube input as follows:

a. Press numeral **7** key to select FIND. The display will show:

b. Key in the desired AI number and press **ENTER**. The display will again show a list of values and the desired one will be highlighted, ready for change.

5. With the Rayotube sensing a source of known temperatures, verify that the AI temperature on the display requires correction. Press the numeral **5** key to select ADJ VALUE. At the prompt, key in the new temperature and press **ENTER**. The emissivity factor will automatically be adjusted to produce the corrected value. There will be a one second delay while the Recorder checks the new value. If the value is allowed (does not exceed limits), the list display will update and the new value will have an asterisk (*) beside it. If the new value is not allowed (exceeds limits) the asterisk will not appear. To change another value, use the cursor keys or FIND feature as previously described.

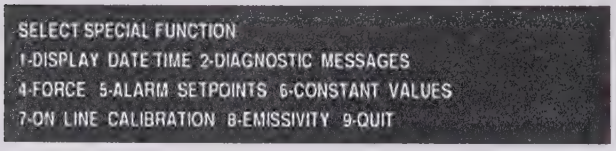
6. Any changed value will be noted on the display by an asterisk (*) alongside it. To restore the original value, highlight the AI number with the cursor (or FIND feature as described), and press numeral **6** key to select BIAS OFF. The original values will be restored and the asterisk will disappear.

7. Press the numeral **8** key (DONE) to exit this function and return to the display interrupted when **SPECIAL FUNCTIONS** was pressed.

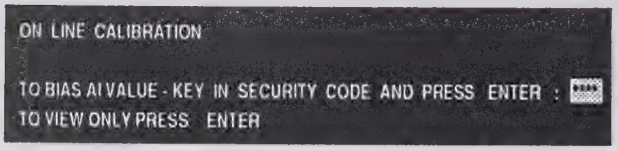
ON-LINE CALIBRATION

Values of analog inputs may be altered (biased) on-line for calibration purposes. Security code entry is required (if security is active). For complete Recorder calibration procedures, see Section 6, Programming. To alter an analog input value, proceed as follows:

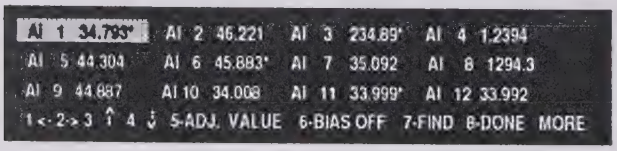
1. Press the **SPECIAL FUNCTIONS** key. The display will show:


SELECT SPECIAL FUNCTION
1-DISPLAY DATE TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT

2. Press the numeral **7** key to select "ON LINE CALIBRATION". The display will show:



3. If security is not active, press **ENTER**. If security is active, key in the security code and press **ENTER**. If security is active and you do not enter the code, press **ENTER** to view the AI values without the ability to change them. The display will show the analog values, as in this example:



4. Use the cursor (1, 2, 3 and 4) keys (and the **MORE** key, if necessary) to highlight the value you wish to change. You may also use the FIND feature to locate the desired AI, as follows:

a. Press numeral **7** key to select FIND. The display will show:

b. Key in the desired AI number and press **ENTER**. The display will again show a list of AI values and the desired one will be highlighted, ready for change.

5. Press the numeral **5** key to select ADJ VALUE. At the prompt, key in the new value and press **ENTER**. The bias will be calculated and the resulting AI value will be displayed. There will be a one second delay while the Recorder checks the new value. If the value is allowed (does not exceed limits) the list display will update and the new value will appear with an asterisk (*) beside it. If the value is not allowed (exceeds limits), the asterisk will not appear. To change another value, use the cursor keys or FIND feature as previously described.

6. Any changed value will be noted on the display by an asterisk (*) alongside it. To restore the original value, highlight the AI number with the cursor (or FIND feature as described), and press numeral **6** key to select BIAS OFF. The original values will be restored and the asterisk will disappear.

7. Press the numeral **7** key (DONE) to exit this function and return to the display interrupted when **SPECIAL FUNCTIONS** was pressed.

DIAGNOSTIC MESSAGES

The presence of unacknowledged diagnostic messages will be indicated by a character "D" at the upper right corner of the display, as shown in Figure 5-7.

When an internal error occurs, the SPEEDOMAX 25000 automatically records the appropriate diagnostic information (error code and time) in an area of memory set aside for the purpose and indicates the presence of a diagnostic message to the operator.

A maximum of 50 such messages can be retained in SPEEDOMAX 25000 memory, available for an operator to view individually on the display, or to print in summary form on the chart. If 50 messages are in memory, an additional message will cause the oldest to be dropped to maintain the limit of 50.

To minimize the time required to review messages on the display, it may be advisable to delete all messages in current memory periodically. If a record is required, a summary printout can be made first. See "To Delete Messages", below, for instructions.

To View Messages

1. To view the diagnostic messages on the display, press the **SPECIAL FUNCTIONS** key. The display will show:

```
SELECT SPECIAL FUNCTION
1-DISPLAY DATE/TIME 2-DIAGNOSTIC MESSAGES
4-FORCE 5-ALARM SETPOINTS 6-CONSTANT VALUES
7-ON LINE CALIBRATION 8-EMISSIVITY 9-QUIT
```

NOTE

Diagnostic messages may also be viewed by use of the ***ACKNOWLEDGE*** *key. See instructions for ALARMS, in a previous part of this section.*

2. Press the numeral **2** key to select DIAGNOSTIC MESSAGES. The display will show:

```
DIAGNOSTIC MESSAGES

1-DISPLAY DIAGNOSTIC MESSAGES 2-DELETE ALL DIAGNOSTIC MESSAGES
3-QUIT
```

3. Press the numeral **1** key and the **MORE** key, as needed, to display all diagnostic messages, as in this example:

```
DIAG 08A  WARM START RESET          8:48:01
DIAG 090  PP DIVIDE BY ZERO        16:50:00
DIAG 08A  WARM START RESET         17:00:35  5 MORE
```

4. Press the **CLEAR/ESC** key to return the display to the function interrupted when **SPECIAL FUNCTIONS** was pressed.

To Delete Messages

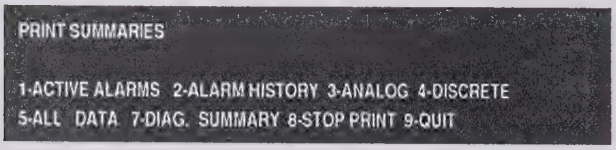
Diagnostic messages must be deleted periodically to clear the diagnostic history memory, as explained previously.

To clear all diagnostic messages, press the **SPECIAL FUNCTIONS** key as described previously in "To View Messages" and select numeral key **2**, DELETE ALL MESSAGES. The display will return to its interrupted function.

To Print Messages

A list of current diagnostic messages may be printed on the full width of the chart, interrupting any ongoing function of the chart, such as trending or datalogging. When the summary printout is complete, the chart will return to its interrupted task. Proceed as follows to print a diagnostic message summary:

1. Press the **SUMMARY** key. The display will show:



2. Press the numeral **7** key to select DIAG SUMMARY. The summary report will print immediately. If you do not wish to wait for the printing to finish, press the numeral **8** key to select STOP PRINT. The chart and display will return to their interrupted functions as soon as printing is completed or STOPPED.

SECTION 6
PROGRAMMING

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6. Programming

GENERAL PROCEDURE

Programming, or configuration, of the SPEEDOMAX 25000 is performed by means of the display and a programmer's keyboard. IBM AT style keyboards or the SPEEDOMAX 25000 hand-held keyboard (Fig. 6-1) are the standard selections. IBM PC or XT keyboards may also be used. The AT keyboard and the hand-held keyboard are completely interchangeable. If a PC or XT style keyboard is to be used, a jumper and DIP switch setting must be made on the SPEEDOMAX 25000 CPU card. Instructions are provided in the Installation section for making these adjustments.

Figure 6-1
Programmer's Keyboard

Refer to Section 4, Controls and Indicators, for a description of the function of each key on the programmer's keyboard. Equivalent IBM keys are noted where appropriate in that section. The instructions in this section, therefore, will refer to use of the programmer's hand-held keyboard only.

Programming of the SPEEDOMAX 25000 must be closely coordinated with the installation process.

Most users will have outlined their process management needs on a process diagram and ordered their SPEEDOMAX 25000 with appropriate circuit cards installed at the factory. Circuit cards are selected for specific functions, such as for processing analog inputs, analog outputs, discrete inputs, etc. See the Specifications section for complete information. Each SPEEDOMAX 25000 is shipped with terminal wiring labels attached which identify the connections for the user to make for the circuit cards installed in that particular unit. Detailed instructions for making these connections are provided in the Installation section.

Step 1 - Establish the Inputs and Outputs

Begin by identifying all of the inputs from and outputs to the process. On paper, list the points for temperature or pressure measurements and their ranges, for example. These will be analog inputs and each will automatically be assigned a unique number by the SPEEDOMAX 25000 according to the terminal to which you connect it. They will be called AI1, AI2, etc.

Follow the same procedure to identify, on paper, all the inputs and outputs, analog and discrete. Identify appropriate analog outputs and their limits.

When all the inputs and outputs have been identified, complete the installation of the equipment and make connections to the process according to instructions provided in the Installation section.

Because it is necessary to be certain about which electrical terminals of the SPEEDOMAX 25000 are connected to which inputs and outputs, it is important to record that information carefully. The Installation section contains a suggested terminal assignment form which we recommend that you copy and use to document the actual connections made during the installation.

When this step is completed, all of the SPEEDOMAX 25000 inputs and outputs from and to your process will be connected and identified with a specific number, assigned automatically by the SPEEDOMAX 25000. For example, if you connect your inlet temperature sensor on boiler no. 1 to SPEEDOMAX 25000 input 14, it would be designated as AI14. As you work further in programming, remember that the SPEEDOMAX 25000 recognizes that particular data point only as AI14. If you wish, you will be able to attach a "descriptor", or a "tag" to it to help you recognize that point when it appears on displays or charts.

For example, the tag designation "BLR # 1" on a report may be more useful to you than the designation "AI14". However, for programming purposes, it is important to note that the SPEEDOMAX 25000 recognizes the point only as AI14, whether you attach a descriptor or tag to it or not. Instructions for applying descriptors and tags are provided in this section.

Step 2 - Plan the Rest of the Data and Functions

Develop your plan further to include all the data points to be handled. Decide on and list all of the functions you will need. These may include pseudo points, constants, logic functions and alarms.

As a very simple example of a pseudo point, suppose you wish to monitor the difference in temperature between two points in your process. You could create a pseudo point for that purpose. The temperature sensor at point 1 might be connected to the SPEEDOMAX 25000 as AI1 and the sensor at point 2 might be AI2. You would create a pseudo point by entering the expression AI1–AI2 on the pseudo point display. The pseudo point would have an identifying symbol of its own; PP1, for example. PP1 would always then be equal to AI1 minus AI2.

Pseudo points of considerable complexity can be created, involving mathematical and logic expressions. For convenience, SPEEDOMAX 25000 software includes a number of pre-programmed pseudo point functions for some common applications. These are described in this section.

In working out these functions and relationships, you may define the need for a variety of parameters and data points. You will need to configure these by type according to instructions in this section.

Step 3 - Configure Data and Functions.

Specifications must be applied to each data point. These will include point descriptor and tag (which are optional, but useful), type (thermocouple types, for example), range (left and right chart limits), numerical values, alarm designations, and others. Step by step instructions are provided in this section.

When data points are individually configured, groups of points must then be identified for multipoint chart printing. Various attributes may be then assigned to groups, points, and chart functions, such as colors, split chart formats, and other features.

It should be noted that identification of data by group is a fundamental operating principle of the SPEEDOMAX 25000. For most operations, the operator is required to enter a group number at the keyboard. The SPEEDOMAX 25000 will assign data points to groups by default at initial startup. It is assumed that the programmer will reassign points to groups as desired. The default configuration will assign data points associated with each I/O card slot to a corresponding group. All the data points associated with the card in slot 1 will be assigned to group 1, all the points on the card in slot 2 will be assigned to group 2, and so forth. If a card slot is empty, the group for that slot will be given a designation of "UNASSIGNED". All points will belong to a group.

The remainder of this section includes some general programming instructions and recommendations, followed by step by step procedures for configuring all data and functions of the SPEEDOMAX 25000.

BASE CATALOG NUMBER 25010 RECORDER WITH FOREIGN LANGUAGES

Changing the Operating Language

Connect the programmer's keyboard and select either Program Mode or View Mode as follows:

1. Press any key on the programmer's keyboard to enter Recorder Control Mode.

2. Cursor to highlight PROG MODE or VIEW MODE and press **ENTER**.

3. If PROG MODE is selected, key in the security code and press **ENTER**.

After successful entry into either of these modes, the display will show:

Cursor to LANG and press **ENTER**. The display will show:

Cursor to the desired language and press **ENTER**. The Recorder is now set up to operate in the selected language. The items that have been translated are as follows:

1. All displays and prompts associated with the operator's keyboard will appear in the selected language.

2. All titles and text associated with Trend, Datalog, and Summary printing will appear in the selected language.

3. The keys on the programmer's keyboard are remapped to conform to the layout of keys on the IBM AT English, French, German or Spanish language keyboard.

CAUTION

If you do not have an AT keyboard for the language selected, change the Recorder back to English before attempting any programming. The position of the keys on the keyboard differs significantly for each language. This difference may give the appearance that the keyboard is not working properly, when in fact, the user is pressing the "wrong" key.

DATA DESIGNATIONS

DATA POINT NUMBERING

The SPEEDOMAX 25000 designates individual data points by parameter type and number. For example, AI20 is a designation for analog input number 20. The SPEEDOMAX 25000 assigns the number by recognizing, in this example, that card slot 2 contains a 15 point Analog Input card and that the fifth input in the slot is therefore an analog input and the input number is 20 (15 points are allocated to each card slot). If a discrete output card happened to be in that slot instead, the fifth input would be designated DO20. These designations are assigned automatically by the SPEEDOMAX 25000, and obviously depend only on the cards installed. It should be noted that it is possible to have unused data point numbers. For example, if a 10 point discrete output card were in slot 2, 5 unused points in that slot would result, because 15 points are allocated to each slot. The 10 points would be designated DO16 through DO25. Points 26-30 would be unused. In this example, if a discrete input card were in the next slot (slot 3), the point following DO25 would be DI31.

The following designations are used in the SPEEDOMAX 25000:

Analog

AI	Analog Input
AO	Analog Output
PP	Pseudo Point (Analog Value)
CN	Numerical Constant

Digital

DI	Discrete Input
DO	Discrete Output
PD	Pseudo Point with a Discrete Output

GROUPS

One of the primary functions of the programming process is to create groups of data points for more effective use of the recorder. A group may consist of from 1 to 30 data points of the same type (all must be either analog or discrete). Up to 20 groups may be designated. An analog group can contain any mix of AI, AO, PP, or CN points. A discrete group can contain any mix of DI, DO, or PD points.

Groups are designated by number assigned by the programmer. Configuration of groups is a simple procedure which is described in this section.

6. Programming

DESCRIPTORS AND TAGS

Descriptors and tags are text symbols for data points to make them recognizable on displays and charts to an operator. For example, the descriptor "TANK 7 LEVEL" will be more useful than a symbol such as "AI21" (Analog Input 21). A descriptor may contain up to 14 alphanumeric characters. A tag is an abbreviated descriptor which may contain up to 7 characters. An individual data point will usually be given both a descriptor and a tag.

The use of descriptors or tags is entirely optional. The SPEEDOMAX 25000 will perform perfectly in all respects without them. Instructions for applying descriptors and tags are provided in this section.

SELECTING POINT OR TAG MODE

A choice must be made by the programmer to designate data points on SPEEDOMAX 25000 displays and charts with the point number or with a tag. If Point Mode is selected, only point numbers (AI20, DO31, for examples) will be used. Tags will not appear on any operating displays or printouts. If Tag Mode is selected, only tags (7 character maximum alphanumeric) will appear. Point numbers will not be shown on most printouts, but will appear on selected displays where correlation is required.

This selection does not affect descriptors (text identifiers, up to 14 characters). Wherever descriptors would normally be used, such as on chart scales and on single point displays, they will still be used, regardless of whether Point Mode or Tag Mode is in effect.

One point to be considered in the use of Tag Mode is that the FIND function used by the operator to locate data points in conjunction with the **SPECIAL FUNCTIONS** key requires point number entry.

NOTE

A tag I.D. can never be entered as a response at the keyboard. Where such entries are required, both tag and point numbers will be displayed for the operator.

Point or Tag Mode selection is a single, global programming selection. Instructions are included in this section. See "Configuring Chart and Print Functions".

ENTERING PROGRAMMING MODE

Refer to the Controls and Indicators section for information on use of the display and a description of the key functions of the programmer's keyboard. Knowledge of how to use these items will be required to perform the procedures in this section.

Connect the programmer's keyboard (or IBM keyboard, if so configured – see the Installation section) as shown in Figure 6-1. Press any key to enter Recorder Program Mode. The display will show:

VIEW MODE

View Mode provides a means to review the SPEEDOMAX 25000 configuration without interrupting its operation. Any chart activities in progress, such as trending or datalogging, will continue while you use the display in View Mode to review data and programming. The security code is not required for access to View Mode. In View Mode, programming entries cannot be made. Menu selections normally used for programming are omitted from most displays. All displays are identified by a highlighted VIEW message in the lower right corner.

To use View Mode, select VIEW MODE from the Recorder control display and follow prompts to select the desired data to view.

RUN MODE

Run Mode is the normal operating mode of the Recorder. This selection is used to restore control to the operator after programming (PROG) or viewing (VIEW) activities are finished. Run Mode may be selected from this menu and also from the next menu presented for either the PROG or VIEW selections. To enter Run Mode, cursor to highlight RUN and press **ENTER**.

6. Programming

PROGRAM MODE

NOTE

Entering Program Mode will take the SPEEDOMAX 25000 off-line and interrupt any functions in progress. If you wish to review the SPEEDOMAX 25000 configuration without making changes and without interrupting current operations, use View Mode.

To begin programming, select PROG from the first display (above). Press **ENTER**. The display will show:

If security is not active, press **ENTER**. If security is active, key in the security code and press **ENTER**.

NOTE

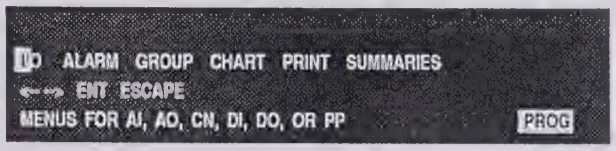
Establishing this 4-character security code for programming activities and also the 4-character code for use of the operator's keyboard is part of user programming. See "Security Code Programming", in this section, for instructions. The establishment of security codes is optional.

The display will show the top level Recorder Program Access menu:

Program Access Display

The message PROG will appear in the lower right corner indicating that the Recorder has exited Run Mode and is in Program Mode.

Cursor to PROG and press **ENTER**. The display will show the top level programming menu:



Top Level Programming Menu

Most programming activities start from this point. In the detailed procedures which follow in this section, references to the top level programming menu refer to this display.

Begin programming by configuring the individual data points.

EXITING PROGRAMMING MODE

To return the SPEEDOMAX 25000 to normal operation (operation from the operator's keyboard), return the display to the top level Recorder Program Access display. This can be done from any point using the **ESC** key. On the Program Access display, cursor to RUN and press **ENTER**.

6. Programming

CONFIGURING DATA POINTS

The first step in programming is to configure the individual data points. This process involves keying in information about each point that the SPEEDOMAX 25000 will retain in memory and use in subsequent operations. For example, a thermocouple in your process may be wired to input number 5 in the first card slot of your SPEEDOMAX 25000. The SPEEDOMAX 25000 recognizes the presence of the input as point number AI5, but has no useful information about it until you configure, or "program" it.

In this example, you would use the programming keyboard and display to "call up" data point AI5 and key in certain information about it. You will key in a description for the point so that the SPEEDOMAX 25000 will know what to print or display to identify it. You might call it "INLET TEMP 1", for example.

You will also want to specify a unit of measure for the input, "DEG C", for example. You will specify the type of thermocouple it is, to define its range, and you will define the chart scale you want when a trend chart of this point is printed.

When you are finished entering this information about the point, the point is configured permanently. You will not need to do it again unless you want to change it. The information will be retained in the SPEEDOMAX 25000 memory, even if power is interrupted.

Now that point AI5 is configured, the operator can use the operator's keyboard and the display to print a trend chart of AI5, or read its current value on the display, or print its value in a variety of formats. For example, now that the SPEEDOMAX 25000 has the information you have entered, it will display:

```
AI5  INLET TEMP1  250  DEG  C
```

Keying in programming data is a simple menu-driven procedure, with prompts appearing on the display at each step, describing in simple english phrases what to do next.

Detailed procedures for configuring all types of data points follow in this section. They are presented by type of data, including:

- Analog Input Programming
- Discrete Input Programming
- Discrete Output Programming
- Analog Output Programming
- Mathematical Constant Programming
- Pseudo Point Programming

Proceed to the next section, "Analog Input Programming," and follow the instructions to program the first data point. If you have a lot of similar points to configure, use the COPY function. Refer to "Using the Copy Function," in this section.

6. Programming

ANALOG INPUT PROGRAMMING

1. From the top level programming menu, select I/O and press **ENTER**. Then select AI and press **ENTER** to produce this display:

AI DESCRIPTION TAG LEFT RIGHT UNITS TYPE T S CL F C
101 SOAK TEMP TMP-101 0 2500 DEG F TYP R F A BK U D
← → ENTER ESCAPE PG UP PG DN COPY SAVE REMOVE
AI NUMBER
PROG

2. The AI number will be highlighted. It is assigned by the SPEEDOMAX 25000 according to AI circuit cards installed and can not be changed. Use the **PG DN** key to advance to the next higher number and the **PG UP** key to obtain the next lower number. To access a "distant" point, press **ENTER**, key in the new point number and press **ENTER**. The new point will be displayed.

Move the cursor to highlight the space under DESCRIPTION. Press **ENTER** to edit. Key in the desired descriptor (maximum 14 characters) and press **ENTER**. To revise the entry, highlight it, press **ENTER** and key in the changes. Characters can be changed individually. Use the **Del** key to erase characters.

3. Cursor to the space under TAG and press **ENTER** to edit. Key in the desired point tag and press **ENTER**. To revise the entry, highlight it and key in the changes. Press **ENTER**.

4. Cursor to highlight the space under LEFT and press **ENTER** to edit. Key in a numerical value for the left scale limit of the chart for this analog input (the value should be in terms of the units of measure to be used – units will be specified in the next step). Press **ENTER**. To change the entry, highlight it, press **ENTER** and key in the entry all over again. Cursor to highlight the space under RIGHT and repeat the process to enter a value for the right side limit of the chart.

5. Cursor to highlight the space under UNITS and press **ENTER** to edit. Key in a text label (up to 6 characters) to identify units of measure on charts and displays. Press **ENTER**.

6. Cursor to the space under TYPE and press **ENTER** to edit. The display will show:

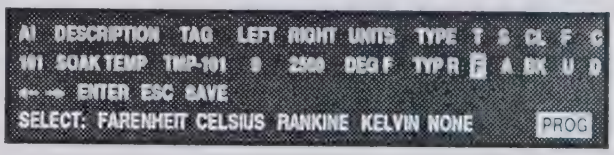
AI 001 TYPE ENTRY: MORE TYPE B TYPE E TYPE J TYPE K TYPE N
TYPE R TYPE S TYPE T WS-W26 PLAT II CU 10 PT 100 PT 1K
→ ← ↑ ↓ ENTER ESC
PRESS ENTER FOR MORE TYPES.
PROG

This is the first of several displays which offer selections to specify the type of analog input for this particular data point. The presence of additional displays is indicated by the first selection in the display, which is MORE. To view the additional selections on the next display, cursor to highlight MORE and press **ENTER**. Repeat to see these additional displays:

AI 001 TYPE ENTRY: MORE EMF V EMF MV PULSE POS PULSE NEG
0-1302 0-0071 0-0074 0-0035 0-0412 0-1729 0-0643 0-0218
→ ← ↑ ↓ ENTER ESC
PRESS ENTER FOR MORE TYPES.
PROG

To view a previous display, cursor to MORE and press **ENTER**. When the desired AI type is highlighted, press **ENTER** to select it. The display will return to the first AI display with the next selection, "T" (temperature) highlighted.

7. With the space under T (temperature), highlighted, press **ENTER** to edit. The display will show:


AI DESCRIPTION TAG LEFT RIGHT UNITS TYPE T S CL F C
101 SOAK TEMP TMP-101 0 2500 DEG F TYP R F A BK U D
← → ENTER ESC SAVE
SELECT: FARENHEIT CELSIUS RANKINE KELVIN NONE
PROG

If the AI is a temperature type of input, cursor to select the scale to be used and press **ENTER**. If the AI is not T/C, RTD, or Rayotube, cursor to NONE and press **ENTER**.

8. Cursor to the "S" (skip) column and press **ENTER** to edit. Then cursor to select SKIP or ACTIVE and press **ENTER**. This selection enables or disables the SKIP function. Selecting SKIP will cause this point to be omitted from charts, on-line displays and alarm levels. Pseudo points or analog outputs using a point in SKIP will continue with a value of zero for the skipped point. Select ACTIVE to permit normal use of the data point. The display will show A for ACTIVE or S for SKIP.

9. Cursor to the "CL" (color) column and press **ENTER** to edit. This is the color selection for printing of this point on charts. Cursor to the desired color (BK, BL, GN, or RD) and press **ENTER**.

10. Cursor to the "F" (failsafe) column and press **ENTER** to edit. This is the selection for chart printing action in the event of thermocouple signal loss for this point. Cursor to the desired failsafe action and press **ENTER**. The choices are: U (full upscale action on open input), D (full downscale on open input), or NONE (no failsafe action on open input).

11. Cursor to the "C" (circuit type) column and press **ENTER** to edit. The display will show:

AI DESCRIPTION TAG LEFT RIGHT UNITS TYPE T S CL F C
101 SOAK TEMP TMP-101 0 2500 DEG F TYP R F A BK U D
← → ENTER ESCAPE PG UP PG DN COPY SAVE REMOVE
SELECT: INDIRECT DIRECT REMOTE
PROG

The DIRECT/INDIRECT selection is for direct or indirect specification of electrical values for the range. (If the necessary hardware is not installed and connected for this point, "N" will appear in this column, indicating that this item cannot be programmed.) If DIRECT is selected for TC or RTD, the SPEEDOMAX 25000 will use electrical limits selected from linearization tables. If DIRECT is selected for a voltage or millivoltage range, the range will be in electrical units. If INDIRECT is selected, then actual electrical range values for lower and upper limits must be entered (see following instructions). The values must be within the electrical limits of the actual input card installed. For example, 4-20 mA transmitter inputs are converted to engineering units by using a "volts" range, entering electrical range limits of 1 to 5 volts (250 ohm resistor shunt assumed across input terminals), and entering the proper low/high limits. Pulse inputs also use the INDIRECT selection.

Indirect/Direct

If the AI is direct, select DIRECT and press **ENTER**. This completes the programming of this AI point. Press the **SAVE** key. If the AI is indirect, select "INDIRECT" and press **ENTER**. The display will show:

Cursor to the "LOCKT" (Low Circuit Value) column and press **ENTER** to edit. Key in the low numerical value for the range and press **ENTER**. Cursor to the "HICKT" (High Circuit Value) column and enter the high value in the same way. Cursor to the "UNITS" column and press **ENTER** to edit. The display will show:

AI DESCRIPTION TAG LOCKT HICKT UNITS
101 SOAK TEMP TMP-101 0 20 MV
← → ENTER ESC SAVE
SELECT: (MV) V PULSE POSITIVE PULSE NEGATIVE
PROG

Cursor to the desired units of measure and press **ENTER**. This completes the programming of this Analog Input. Press the **SAVE** key to save the configuration of this point in the SPEEDOMAX 25000 memory. If similar points are to be programmed, see "Using the Copy Function" in this section.

Remote

The REMOTE selection allows the Recorder to accept Analog Input values written to the Recorder over the serial communications link. These remote analog input values can be used wherever a measured analog input would be used (displays, trends, alarm levels, pseudo points). Any input position (1 through 135) may be configured as a remote analog input.

Following keyboard procedures described previously for INDIRECT/DIRECT, make the following selections to configure a remote analog input:

Range Type – must be set to NONE
Temp Scale – must be set to NONE
Failsafe – must be set to NONE

Press the **SAVE** key when finished. See "Using the Copy Function" to configure additional points.

6. Programming

USING THE COPY FUNCTION

The SPEEDOMAX 25000 features a COPY function for use in programming. Its purpose is to reduce the need for repetitious keyboard entries. To use this feature, key in the entries for one data point, then COPY that information to several others. Then edit the other points one at a time to revise them as needed. The following example of the use of the COPY feature when configuring a typical analog input illustrates the procedure:

1. From the top level programming menu, cursor to I/O and press **ENTER**. The display will show:

2. With the cursor on AI, press **ENTER**. The display will show a display similar to this example, which is a completely programmed Analog Input, AI1:

AI DESCRIPTION TAG LEFT RIGHT UNITS TYPE T S CL F C
1 SOAK TEMP TMP-101 0 2500 DEG F TYP R F A BK U D
<--> ENTER ESCAPE PG UP PG DN COPY SAVE REMOVE
AI NUMBER
PROG

3. Press the **COPY** key on the keyboard. The display will show the point data with the COPY message:

AI DESCRIPTION TAG LEFT RIGHT UNITS TYPE T S CL F C
101 SOAK TEMP TMP-101 0 2500 DEG F TYP R F A BK U D
0-9 ENT ESC
COPY THIS ITEM TO THRU
PROG

4. To copy to a range of AI points, key in the digits for the first AI point number of the range (for example, 9, or 10) and press **ENTER**. The cursor will move to the second position. Key in the last AI point number of the range and press **ENTER**.

To copy to only one other AI point, either key in the same number for both entries, or press **ENTER** twice after the first entry.

The display will return to the previous display.

5. With the cursor on AI, enter the copied point number, or use the **PG DN** or **PG UP** keys to scroll to the new copied points and edit the descriptions, tags or other data according to instructions in the following individual procedures for programming the various types of data points. In the preceding example, you would follow the procedures in "Analog Input Programming".

NOTE

- A data point must be completely configured and SAVEd before it can be copied.
- Copying pseudo points can present special problems. Refer to the Pseudo Point Programming section for information.

DISCRETE INPUT (DI) PROGRAMMING

From the top level I/O programming display, cursor to highlight DI and press **ENTER**. The display will show:

DI DESCRIPTION TAG ON LABEL - OFF D/R A/E
1 FURNACE DOOR FR DOOR OPEN CLOSED D ALM
<--> ENT ESC PGUP PGDN COPY SAVE REMOVE
DI NUMBER
PROG

The DI number (DI1 in the sample display illustrated) is assigned automatically by the SPEEDOMAX 25000 according to circuit cards installed. To obtain another point, use the **PG DN** or **PG UP** keys to scroll. For a "distant" point, press **ENTER** to edit the point number (DI). Enter the desired number and press **ENTER**.

1. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in the text descriptor (14 characters maximum) and press **ENTER**. Cursor to the "TAG" column, press **ENTER** to edit and key in a tag, (7 characters maximum). Press **ENTER**. Descriptors and tags are optional.

2. Cursor to ON LABEL and press **ENTER** to edit. Key in a text description (maximum 6 characters) of the ON status of the DI and press **ENTER**. Cursor to OFF LABEL and enter a label for OFF status in the same way. Examples of ON and OFF labels might be HIGH/LOW, IN/OUT, etc. If no labels are entered, the labels will be ON and OFF. These labels will appear on cha and displays.

The "D/R" column indicates the origin of the DI point state, DIRECT, REMOTE, or NONE. The DIRECT selection indicates that there is a DI card installed for this point. The REMOTE selection allows the Recorder to accept the DI state over the serial communications link. Remote DI points can be used wherever a hardware DI point would be used (datalogs, alarms, pseudo points, optional features). NONE indicates that there is no DI hardware installed for this point.

3. Cursor to A/E and press **ENTER** to edit. Select a designation of NONE, ALARM, or EVENT for this DI. If the DI is designated here as an alarm or event, it will be printed as such on right hand chart margins (if this feature is turned on) when it changes state. Press **ENTER**.

4. Press the **SAVE** key to save the configuration of this point in the SPEEDOMAX 25000 memory.

The SPEEDOMAX 25000 offers the capability to print discrete events on the chart (Event Markers). See "Programming an Event Marker" in this section.

DISCRETE OUTPUT (DO) PROGRAMMING

From the top level I/O programming display, cursor to highlight DO and press **ENTER**. The display will show:

DO DESCRIPTION TAG ON LABEL OFF D/R A/E ASSIGNMENT
12 OVERHEAT ALM OVRHEAT ALARM NORMAL D ALM AL15
←→ ENT ESC PGUP PGDN COPY SAVE REMOVE
DO NUMBER
PROG

The DO number (DO12 in the sample display illustrated) is assigned automatically by the SPEEDOMAX 25000 according to circuit cards installed. To obtain another point, use the **PG DN** or **PG UP** keys to scroll. For a "distant" point, press **ENTER** to edit the point number (DO). Enter the desired number and press **ENTER**.

1. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in the text descriptor (14 characters maximum) and press **ENTER**. Cursor to the "TAG" column, press **ENTER** to edit and key in a tag, (7 characters maximum). Press **ENTER**. Descriptors and tags are optional.

2. Cursor to ON LABEL and press **ENTER** to edit. Key in a text description (maximum 6 characters) of the ON status of the DO and press **ENTER**. Cursor to OFF LABEL and enter a label for OFF status in the same way. Examples of ON and OFF labels might be HIGH/LOW, IN/OUT, etc. If no labels are entered, the labels will be ON and OFF. These labels will appear on charts and displays.

3. The "D/R" column indicates the origin of the DO point state, DIRECT, REMOTE, or NONE. The DIRECT selection indicates that there is a DO card installed for this point. The REMOTE selection allows the Recorder to accept the DO state over the serial communications link. Remote DO points can be used wherever a hardware DO point would be used (datalogs, alarms, pseudo point inputs). NONE indicates that there is no DI hardware installed for this point.

If the DO is selected as the output of a "soft alarm" level, the "DR" column will automatically be set to REMOTE (refer to "Alarm Level Programming" later in this section). This selection cannot be changed from this display. Any attempt to change this selection will result in an error when **SAVE** is pressed.

Cursor to A/E and press **ENTER** to edit. Select a designation of NONE, ALARM, or EVENT for this DO. If the DO is designated here as an alarm or event, it will be printed as such on righthand chart margins (if this feature is turned on) when it changes state. Press **ENTER**.

NOTE

*If this DO has been assigned to an alarm level (see "Alarm Level Programming" in a later part of this section), the designation "ALM" will appear in this (A/E) column. This designation cannot be changed on this display. It results from Alarm Level programming. Any attempt to change it on this display will result in an error message when **SAVE** is pressed.*

4. The final column, "ASSIGNMENT", will be filled in as a result of other programming. In the example display shown, the DO is an output of AL15.

In the case of linked alarms (see "Alarm Level Programming"), the entire list of assignments can be reviewed by moving the cursor to the ASSIGNMENT column and repeatedly pressing **ENTER**. At the end of the assignment list, the message END OF DATA will appear.

5. Press the **SAVE** key to save the configuration of this point in the SPEEDOMAX 25000 memory.

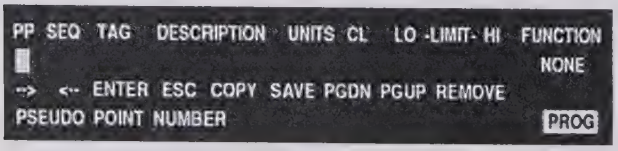
The SPEEDOMAX 25000 offers the capability to print discrete events on the chart (Event Markers). See "Programming an Event Marker" in this section.

PROGRAMMING AN EVENT MARKER

An event marker is created in the SPEEDOMAX 25000 by programming a pseudo point which utilizes the SIGNAL SELECT function. By assigning different analog values for the pseudo point for the ON and OFF states of the discrete element, a trend chart of the pseudo point becomes an event marker. Up to 30 event markers can be "trended" at one time, if so desired.

Complete instructions for pseudo point programming are provided later in this section. For convenience, the procedure for programming an event marker is presented in summary here.

1. From the top level I/O programming menu, select PP and press **ENTER**. The display will show:



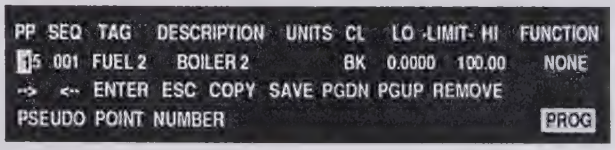
2. With the "PP" column highlighted, press **ENTER** to edit. Key in a new pseudo point number (1-60) and press **ENTER**. Cursor to the "SEQ." column and press **ENTER** to edit. Key in a execution sequence number (1-60) and press **ENTER**. Cursor to the "TAG" column and press **ENTER** to edit. Key in a tag description (7 characters maximum) for the event marker on the chart, and press **ENTER**. Repeat the procedure for the DESCRIPTION column, if desired. Skip the "UNITS" column and cursor to the "CL" column and press **ENTER** to edit. Cursor at the prompt to select a color for chart printout for the event marker. Press **ENTER**.

3. Cursor to the "LO-LIMIT" column and press **ENTER** to edit. Key in a value of 0 and press **ENTER**. Repeat the procedure for the "LIMIT-HI" column, entering a value of 100 for the high limit.

NOTE

Other limits may be preferred, depending on how you wish the event marker to appear, and whether you plan to have it printed as part of a group, using a group scale. Refer to the Pseudo Point Programming section and the Group Programming section for more information.

At this point, the display would look like this typical example:


PP SEQ TAG DESCRIPTION UNITS CL LO -LIMIT- HI FUNCTION
15 001 FUEL 2 BOILER 2 BK 0.0000 100.00 NONE
--> <-- ENTER ESC COPY SAVE PGDN PGUP REMOVE
PSEUDO POINT NUMBER
PROG

4. Cursor to the "FUNCTION" column and press **ENTER** to edit. Because you are programming a new pseudo point (PP15), the following display will appear. If you were editing an existing pseudo point, the prompt SELECT NEW FUNCTION would appear. A YES response would also produce this following display:

6. Programming

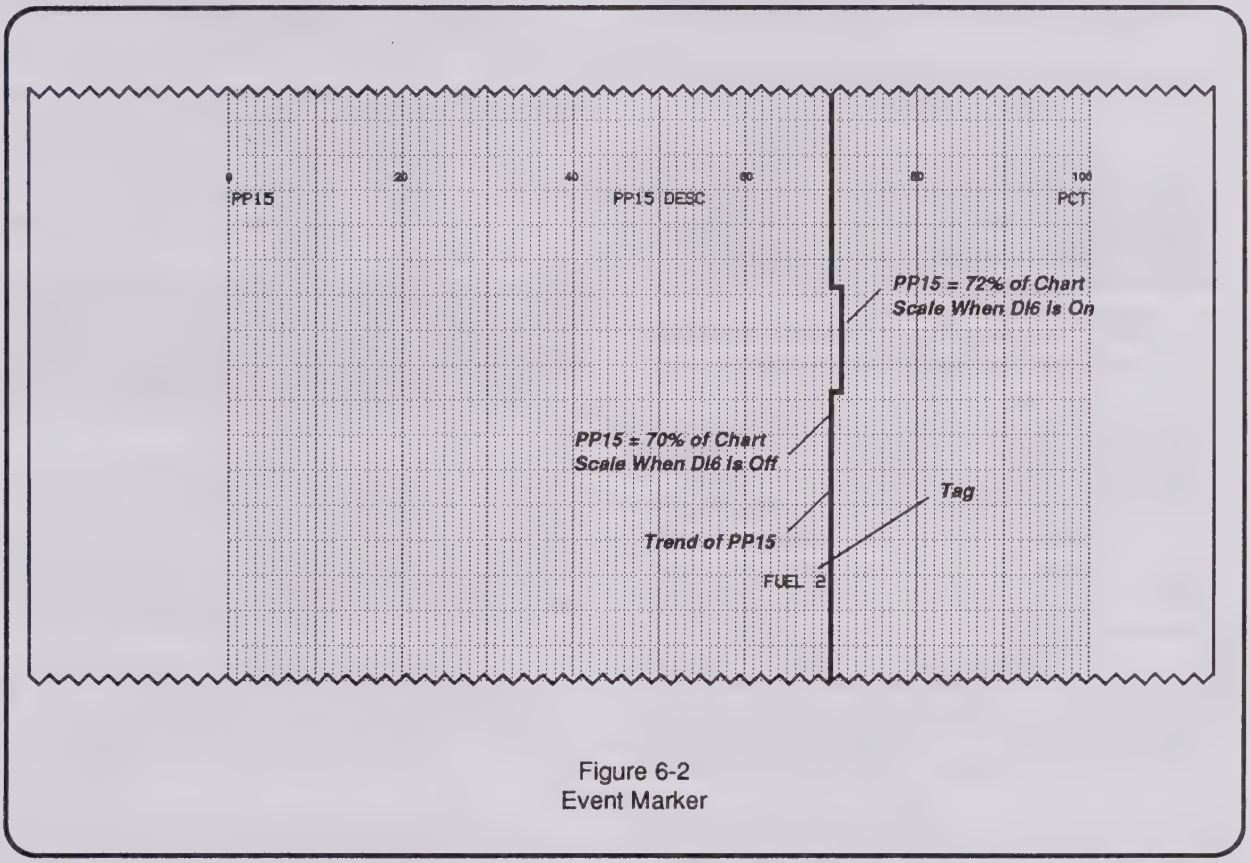
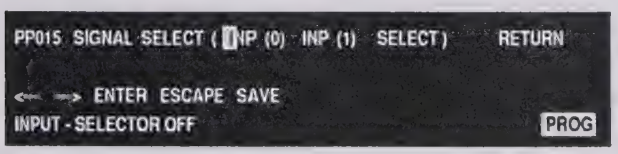


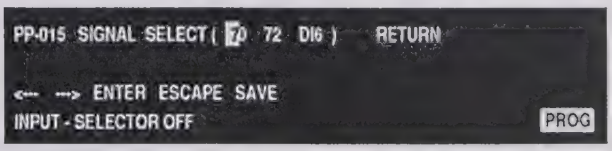
Figure 6-2
Event Marker

5. Cursor to MORE and press **ENTER** to view more selections. Cursor to SIGNAL SELECT and press **ENTER**. The display will show:



Cursor to INP 0 and press **ENTER** to edit. Cursor to select NUMERIC and press **ENTER**. Key in **70** and press **ENTER**. Cursor to INP 1 and repeat the procedure, entering a value of **72**.

Cursor to SELECT and press **ENTER** to edit. Cursor to select the parameter type for the event (DI, DO, PD) and press **ENTER**. At the prompt, key in the number of the particular data point and press **ENTER**. Assuming you were to enter DI6 as the event to be marked, the display would look like this:



6. Press **SAVE** to save the PP configuration in SPEEDOMAX 25000 memory. To use the event marker, plot a trend of PP15 (when in Run Mode, from the operator's keyboard – see the Operation section for instructions). For this particular example, the event marker would look like Figure 6-2.

6. Programming

ANALOG OUTPUT (AO) PROGRAMMING

From the top level I/O Programming menu, select AO and press **ENTER**. The display will show:

```
AO DESCRIPTION TAG    SOURCE  LO -INP- HI  LO -OUT- HI  CL
17 RETRANS     VAT-001 AI12   0.0000 1200.0 0.00 100.00 GN
--> <-- ENTER ESC PGUP PGDN COPY SAVE REMOVE
ANALOG OUTPUT NUMBER                              PROG
```

The AO number is assigned by the SPEEDOMAX 25000 according to the circuit cards installed.

1. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in a text descriptor (14 characters maximum) for the analog output and press **ENTER**. To revise an entry, highlight it again, press **ENTER** and key in the entry all over again. Cursor to the "TAG" column, press **ENTER** to edit and key in a text tag (7 characters maximum), in the same way. Descriptors and tags are optional.

2. Cursor to the "SOURCE" column and press **ENTER** to edit. At the prompt, cursor to select the type of input (AI, AO, PP, or CN). Press **ENTER**, then key in the input point number (12 in the example, AI12, above).

3. Cursor to the "LO-INP" (Input Low Limit) column and press **ENTER** to edit. Key in the numerical value for the low input limit and press **ENTER**. Repeat the procedure for the next 3 columns, INP-HI, LO-OUT and OUT-HI to enter, respectively, the input high limit and the low and high output limits.

The source is an analog value. Specify the end points of the analog source which will represent the high and low limit for the analog output module.

For a voltage retransmission output, the output is 0-5 VDC or 0-10 VDC for a high limit of 100 and 0 for a low limit of 0. The high and low voltage limits may be set anywhere within the 0 and 100 limits.

A low limit of 10 and a high limit of 50 will provide a 1-5 VDC output span (Fig.6-3).

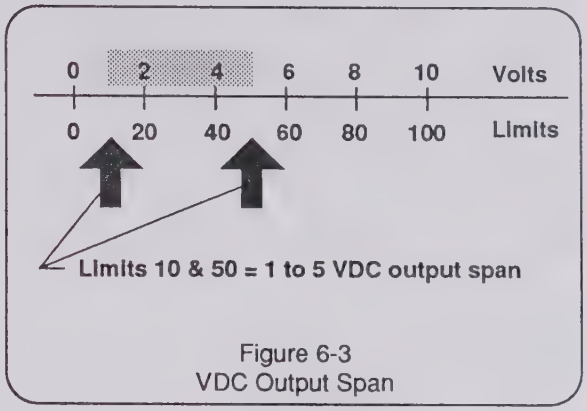


Figure 6-3
VDC Output Span

4. Cursor to the "CL" (color) column and press **ENTER** to edit. Cursor to select the color (BK, BL, GN, RD) for printing this AO on charts and press **ENTER**.

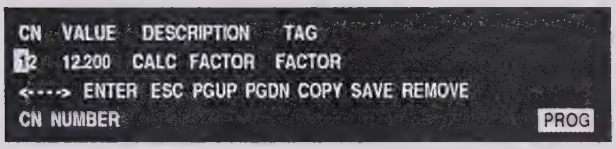
5. Press **SAVE** to save the configuration of this AO in the SPEEDOMAX 25000 memory.

6. Programming

MATHEMATICAL CONSTANT (CN) PROGRAMMING

TO program numerical values for constants to be used in mathematical operations, proceed as follows:

1. From the top level I/O Programming menu, select CN and press **ENTER**. The display will show:



The number of the constant (CN column) is assigned by the SPEEDOMAX 25000, starting at 1. Use the **Pg Dn** and **Pg Up** keys to select the desired point numbers to program. To access a "distant" point, press **ENTER**. Key in the new point number and press **ENTER**. Up to 50 constants may be programmed and stored in the SPEEDOMAX 25000 memory.

2. Cursor to the "VALUE" column and press **ENTER** to edit. Key in the numerical value for the constant and press **ENTER**. The value can be from -99,999 to +999,999.

3. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in a text descriptor (14 characters maximum) for the constant and press **ENTER**. To revise an entry, highlight it again, press **ENTER** and key in the changes. Cursor to the "TAG" column, press **ENTER** to edit and key in a text tag (7 characters maximum), in the same way. Descriptors and tags are optional.

4. Press **SAVE** to save the configuration of this CN in the SPEEDOMAX 25000 memory.

PSEUDO POINT (PP) PROGRAMMING

A pseudo point is a data point whose value is derived from other values and relationships. It is often derived from calculations involving other data point values in particular mathematical or logical expressions.

In addition to creating pseudo points, programming also establishes the sequence of execution of pseudo points. The number entered in the "SEQ" column establishes a numerical order in which pseudo points are executed. An entry of zero will nullify the item (the programming will remain, but the point will not execute). Execution occurs once during each "scan cycle." During the "scan," or "update," interval, the SPEEDOMAX 25000 CPU reads all inputs, performs all calculations and alarms and sets all outputs. At the end of the scan interval, the "scan" is repeated. The scan interval is one second.

The scan interval must be long enough for the CPU to execute all pseudo points which are programmed. ***It is important, therefore, not to program more pseudo point functions than there is time available.*** Refer to Table 6-1 for time allocations and the times required for individual functions. A maximum of 60 pseudo points may be programmed.

Depending on how they are programmed, pseudo points may be treated in subsequent operations as analog data points, discrete data points, or both analog and discrete. A new pseudo point must be assigned to a group or it cannot be printed or displayed. To assign it to a group, see instructions in "Configuring Groups," in this section.

6. Programming

TABLE 6-1
Time Requirements for Pseudo Point Functions

Functions	Time Required (millisec)
1. Scale	.5887
2. Signal Select	.2717
3. Signal Clamp	.2264
4. Low Select	1.4289
5. High Select	1.4289
6. Scaled Square Root	2.2187
7. Single Input Time Avg.	.8573
8. Multiple Input Avg. 25 inputs	1.6755
9. Single Input Deviation	.5887
10. Multiple Input Deviation	.5887
11. Totalization - Hours	.5888
12. Totalization - Minutes	.5888
13. Mass Flow /Square Root	2.4451
14. Drum Level	.5887
15. Compare - Equal	.3170
16. Compare -Less Than	.3170
17. Compare - Greater Than	.3170
18. Compare - Less/Equal	.3170
19. Compare- Greater/Equal	.3170
20. Time Compare	.5887
21. Logic "And"	.3622
22. Logic "Or"	.3622
23. Logic "XOR"	.3622
24. Logic "Not"	.3622
25. Peak Picking - High	.3623
26. Peak Picking - Low	.3623
27. Rate of Change	.5988

Math Functions	Time Required (millisec)
Add	.1560*
Subtract	.1600*
Multiply	.1600*
Divide	.1910*
Square Root	1.6300*
Log x	1.8872*
Ln x	1.6962*
e^x	2.2638*
y^x	3.4870*
Absolute Value	.2500*

Math Functions	Limits
e^x	$-40 \leq x \leq 40$
ln (x)	$1 \times 10^{-6} \leq x \leq 1 \times 10^{6}$
log (x)	$1 \times 10^{-6} \leq x \leq 1 \times 10^{6}$
y^x	$0 \leq x \leq 1 \times 10^{6}$ and $-40 \leq x \ln(y) \leq 40$
sqroot(x)	$x \geq 0$
abs(x)	no limits

** plus overhead of .3200 per pseudo point*

6. Programming

Data Entry

A complete PP entry specifies:

1. Execution sequence
2. PP formula or function
3. High limit (PP with analog result only)
4. Low limit (PP with analog result only)

Specific procedures for data entry are given below. Before proceeding, read and observe the following general rules for Pseudo Points:

Pseudo Point Rules

1. When creating mathematical expressions, a maximum of 20 variables per expression is allowed. Mathematical expressions do not use a hierarchy of operations. Parentheses must be used (a maximum of 10 sets of parentheses may be used in any one expression).

2. Create separate pseudo points for complex exponents, then reference the exponent pseudo point number in the complete expression.
Example:

PP4 (AI 1 + CN 3)/2
PP5 (AI 7 + AI9)EXP PP4

3. When using the optional hand-held keyboard, multiply must use the x operator, e.g.:
AI3 x (AI2 + AI4).

NOTE

*The SPEEDOMAX 25000 display will show an asterisk (*) for a multiplication sign. When using the optional hand-held keyboard, use the **X** key to multiply. For all other keyboards, use the askerisk (*) key.*

4. Minus cannot be used for negation. It must be used for arithmetic subtraction only. For example, –AI4 + AI2 cannot be used. For subtraction, it must be written AI2 –AI4.

5. To test an equation, it may be helpful to write it using CN numbers for constants, then re-write it using the correct actual numbers or variables.

6. All pseudo points having analog outputs must have high and low limits.

7. High limits must be more positive than low limits; for example: LO=-8, HI= -2.

8. A single analog variable may be a pseudo point; for example, PPI = AI2.

9. Execution sequence number "0" turns pseudo points off (without loss of programmed data).

10. Press **ESC** to delete entries made in present session (since last **SAVE**).

11. The exponent for the PWR (Y^x) function cannot be a compound expression.
For example, AI2 PWR (CN1 + CN2) is not allowed.

Data Entry Procedure

From the top level I/O programming menu, select "PP" and press **ENTER**. The display will show:

PP SEQ TAG DESCRIPTION UNITS CL LO LIMIT HI FUNCTION
5 001 FUEL 2 BOILER 2 BK 0.0000 100.00 NONE
→ ← ENTER ESC COPY SAVE PGDN PGUP REMOVE
PSEUDO POINT NUMBER
PROG

1. Highlight the first column (PP) and press **ENTER** to edit. Then key in a PP number (1-60). For a new PP, enter a new number and press **ENTER**. To edit an existing PP, enter its number and press **ENTER**. You may also use the **PG DN** and **PG UP** keys to scroll to the desired PP number.

2. Cursor to the "SEQ" column and press **ENTER** to edit. Key in a number from 1-60 in the SEQ column to establish the order in which the pseudo point is to be executed. Press **ENTER**. When a new pseudo point is added to the list, the next higher number available should be used. Numbers may be changed as desired. Entering a value of zero in the execution sequence column will turn the pseudo point OFF.

NOTE

Using a sequence number twice causes the older entry containing this number to have a sequence number of 0 with all other data unchanged. The new entry will use the entered sequence number.

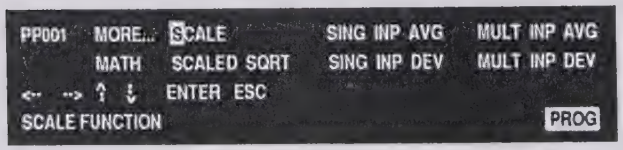
3. Cursor to the "TAG" column and press **ENTER** to edit. Key in a text description for the pseudo point (7 characters maximum) and press **ENTER**. Repeat the procedure for the "DESCRIPTION" column to enter a descriptor of up to 14 characters. Tags and descriptors are optional.

4. Cursor to the "UNITS" column, press **ENTER** and key in a text description for units of measure to appear on displays and charts (6 characters maximum). Press **ENTER**.

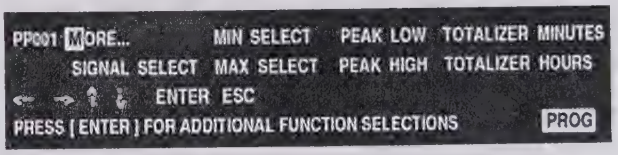
5. Cursor to the "CL" (color) column and press **ENTER** to edit. Cursor to a color selection (BK, BL, GN, RD) for chart printouts of this PP and press **ENTER**.

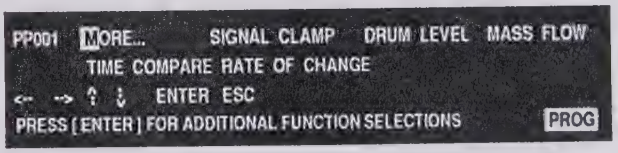
6. Cursor to the "LO-LIMIT" column and press **ENTER** to edit. Key in a numerical value for the PP lower limit (6 digits maximum, including negative sign and decimal point) and press **ENTER**. Repeat the procedure for the "LIMIT-HI" column, entering a value for the high limit.

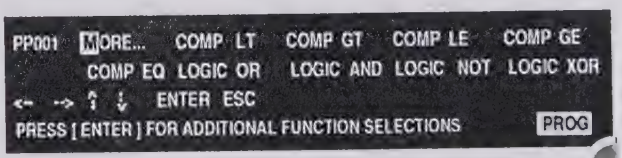
7. Note the "FUNCTION" column. If you are programming a new PP, the column will contain the word "NONE". If you are editing an existing PP, the assigned function will be displayed (for example, in the previous sample display, SCALE is displayed). For a new PP, or if you wish to change the function type of an existing PP, cursor to the "FUNCTION" column and press **ENTER**. (If you are finished editing an existing PP and do not want to change the function type, press **SAVE**.) If you are editing an existing PP, and wish to change the function type, at the prompt to SELECT NEW FUNCTION, cursor to select YES and press **ENTER**. The display will show:



This is the first of several displays to allow selection of the available PP functions. To view all selections, cursor to highlight the MORE selection and press **ENTER**. Repeat to view these additional displays:


PP001 MORE... MIN SELECT PEAK LOW TOTALIZER MINUTES
SIGNAL SELECT MAX SELECT PEAK HIGH TOTALIZER HOURS
<-- --> ↑ ↓ ENTER ESC
PRESS [ENTER] FOR ADDITIONAL FUNCTION SELECTIONS
PROG


PP001 MORE... SIGNAL CLAMP DRUM LEVEL MASS FLOW
TIME COMPARE RATE OF CHANGE
<-- --> ↑ ↓ ENTER ESC
PRESS [ENTER] FOR ADDITIONAL FUNCTION SELECTIONS
PROG


PP001 MORE... COMP LT COMP GT COMP LE COMP GE
COMP EQ LOGIC OR LOGIC AND LOGIC NOT LOGIC XOR
<-- --> ↑ ↓ ENTER ESC
PRESS [ENTER] FOR ADDITIONAL FUNCTION SELECTIONS
PROG

Note that the selections displayed are the prepared pseudo point functions listed in Table 6-1, plus a MATH selection. The MATH selection is for writing of mathematical expressions directly on the display to define a pseudo point.

Select the desired function and complete the PP programming according to instructions for the particular function. Instructions for using the MATH functions are provided below. After those instructions, additional instructions for use of the prepared functions are given.

When data entry is complete, press **SAVE** to save the pseudo point in SPEEDOMAX 25000 memory. Assign the new pseudo point to whatever group you prefer. See "Analog Group Programming," in this section.

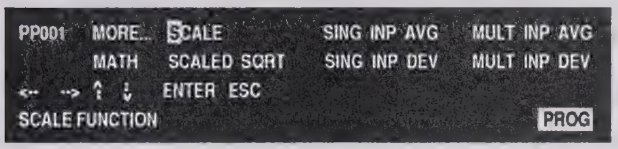
NOTE

The PP must be assigned to a group or it cannot be printed or displayed.

6. Programming

Pseudo Point Mathematical Data Entry (MATH function)

1. On the top level PP programming display, select FUNCTION and enter YES for prompt SELECT NEW FUNCTION. The display will show:



2. Cursor to select MATH and press **ENTER**. The display will show:

The display is ready for data entry. The active keys on the programmer's keyboard are listed on the message line. Following the rules described previously, key in the mathematical expression to which the PP will be equal. Figure 6-4 illustrates the procedure. Note that DELETE deletes the item under the cursor (highlighted). The equation will compress to fill the space. The **REMOVE** key deletes the entire PP.

Figure 6-5 shows examples of how various PP math expressions would appear on the display when keyed in.

Using Pseudo Point Prepared Functions

This section describes in detail each of the prepared pseudo point functions which are listed in Table 6-1 in detail. With each description, a sample of the SPEEDOMAX 25000 display for the function is illustrated. Accompanying the display are submenus of selections which will appear in the display message line, as the cursor is placed on the various items on the upper lines of the display.

Make entries on these displays in the same manner as described previously. In summary:

1. Use the cursor keys to highlight a selection in the upper part of the display. The message line will indicate the item.

2. Press **ENTER** to edit the item. The message line will show a menu of selections to be entered for the item.

3. Use the cursor keys to highlight the menu item selection and press **ENTER**. The selected menu item will appear on the display, or other menu items will appear for an additional selection. When a numerical entry is required, the prompt ENTER NUMBER will appear.

4. Remember to press **SAVE** to save the pseudo point to SPEEDOMAX 25000 memory when you have finished entering it. Also, remember to assign a new pseudo point to a group.

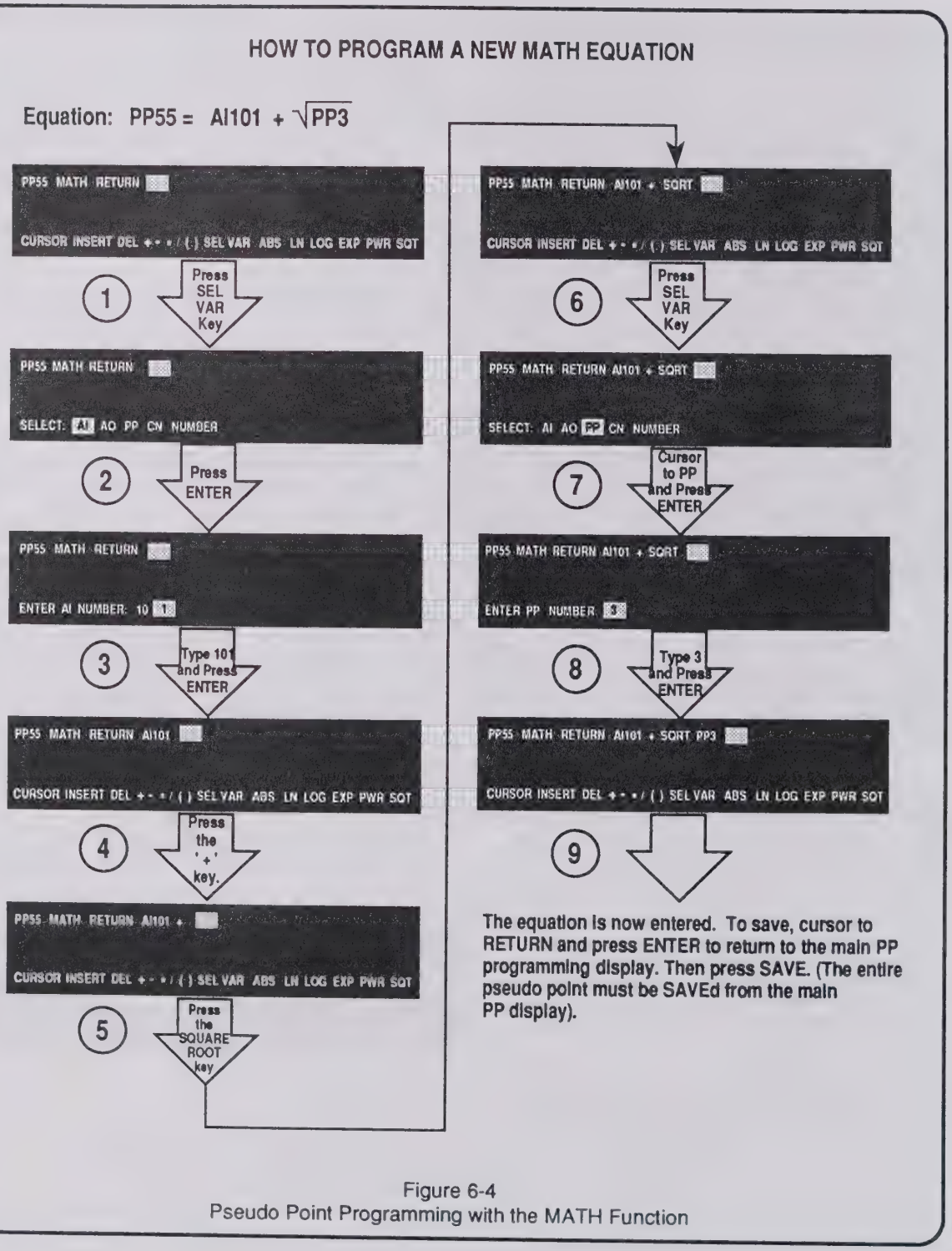

HOW TO PROGRAM A NEW MATH EQUATION
Equation: PP55 = AI101 + √PP3
PP55 MATH RETURN
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
1
Press SEL VAR Key
PP55 MATH RETURN
SELECT: AI AO PP CN NUMBER
2
Press ENTER
PP55 MATH RETURN
ENTER AI NUMBER: 10 1
3
Type 101 and Press ENTER
PP55 MATH RETURN AI101
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
4
Press the '+' key.
PP55 MATH RETURN AI101 +
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
5
Press the SQUARE ROOT key
PP55 MATH RETURN AI101 + SQRT
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
6
Press SEL VAR Key
PP55 MATH RETURN AI101 + SQRT
SELECT: AI AO PP CN NUMBER
7
Cursor to PP and Press ENTER
PP55 MATH RETURN AI101 + SQRT
ENTER PP NUMBER 3
8
Type 3 and Press ENTER
PP55 MATH RETURN AI101 + SQRT PP3
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
9
The equation is now entered. To save, cursor to RETURN and press ENTER to return to the main PP programming display. Then press SAVE. (The entire pseudo point must be SAVEd from the main PP display).

Figure 6-4
Pseudo Point Programming with the MATH Function

HOW TO EDIT AN EXISTING MATH EQUATION

change equation:

PP12 = AI12 + AI14 / CN12

to:

PP12 = AI12 + AI14 / (CN12 * 1.234)

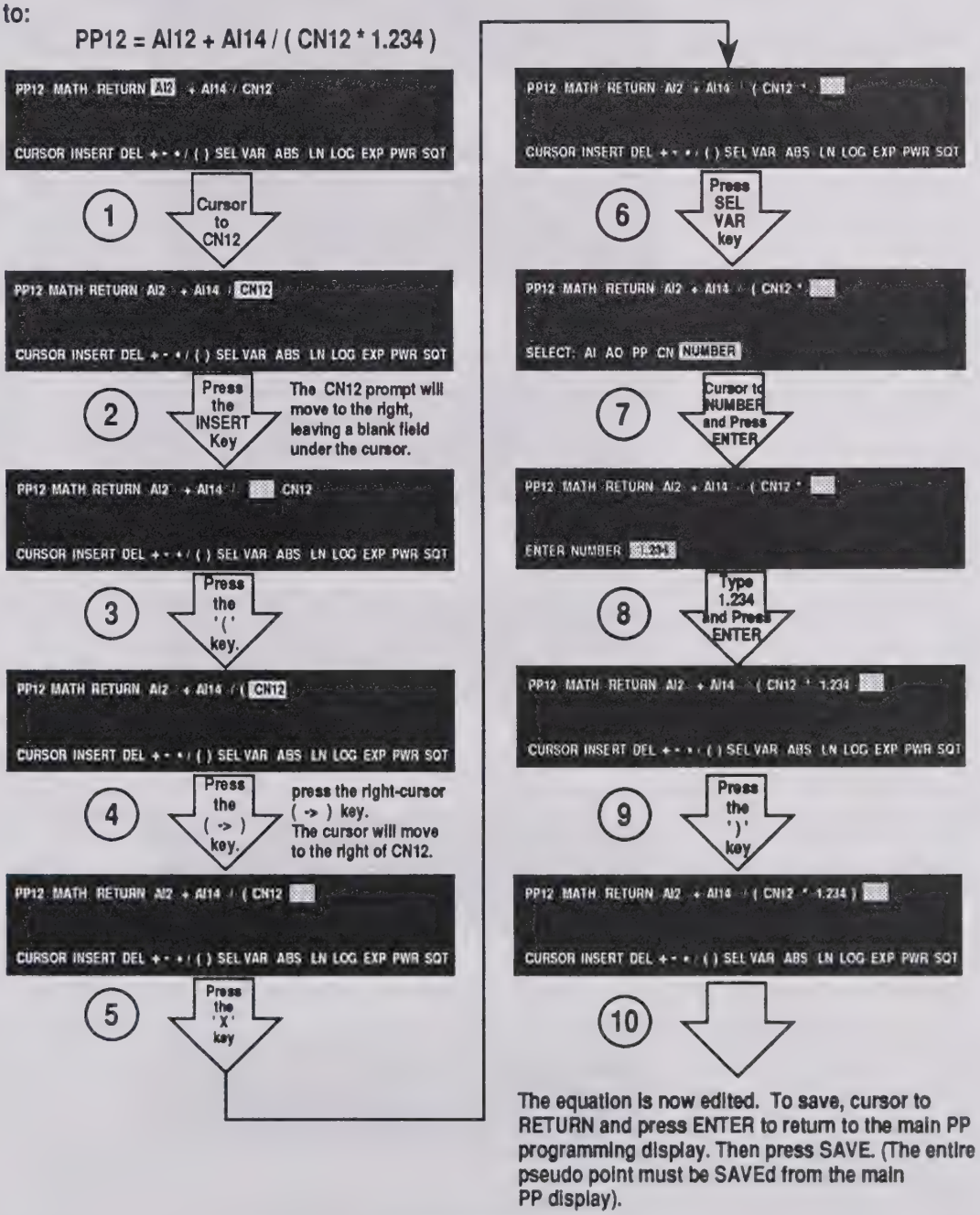

PP12 MATH RETURN AI2 + AI14 / CN12
CURSOR INSERT DEL + - * / ( ) SEL VAR ABS LN LOG EXP PWR SQT
1
Cursor to CN12
PP12 MATH RETURN AI2 + AI14 / CN12
2
Press the INSERT Key
The CN12 prompt will move to the right, leaving a blank field under the cursor.
PP12 MATH RETURN AI2 + AI14 / CN12
3
Press the '(' key.
PP12 MATH RETURN AI2 + AI14 / (CN12
4
Press the (->) key.
press the right-cursor (->) key. The cursor will move to the right of CN12.
PP12 MATH RETURN AI2 + AI14 / (CN12
5
Press the 'X' key
PP12 MATH RETURN AI2 + AI14 / (CN12 *
6
Press SEL VAR key
PP12 MATH RETURN AI2 + AI14 / (CN12 *
SELECT: AI AO PP CN NUMBER
7
Cursor to NUMBER and Press ENTER
PP12 MATH RETURN AI2 + AI14 / (CN12 *
ENTER NUMBER
8
Type 1.234 and Press ENTER
PP12 MATH RETURN AI2 + AI14 / (CN12 * 1.234
9
Press the ')' key
PP12 MATH RETURN AI2 + AI14 / (CN12 * 1.234)
10
The equation is now edited. To save, cursor to RETURN and press ENTER to return to the main PP programming display. Then press SAVE. (The entire pseudo point must be SAVEd from the main PP display).

Figure 6-4 con't

PSEUDO POINT MATH EQUATION EXAMPLES

example: pp8 = a*(b-(c*(((d+e)/f)*h+j))-(K*L))

PP8 MATH RETURN AI101 * (AI102 - (AI103 * (((AI104 + AI105
) / AI106) * AI107 + AI108)) - (AI109 * AI110))
CURSOR INSERT DEL +- +/ ( ) SEL VAR ABS LN LOG EXP PWR SQT

example: pp9 = log (a + b)

example: PP10 = ln (a + b)

example: PP11 = $e^{(a+b)}$

example: PP12 = a^{b}

example: PP13 = square root (a + b)

Figure 6-5
How Common Pseudo Point Math Equations Look
on the Display When Entered

Pseudo Point Prepared Functions

1. SCALING FUNCTION ANALOG OUTPUT

SCALE (INPUT, LO IN, HI IN, LO OUT, HI OUT)
(1) (2) (3) (4) (5)

Linearly scales the value of the input variable based on the limits listed. As the input varies between the LO IN and HI IN, the output varies between the LO OUT and HI OUT. Clamps value between LO OUT & HI OUT.

(1) INPUT - Analog Variable, Numerical Value
(2) LO IN - Analog Variable, Numerical Value within Input limits
(3) HI IN - Analog Variable Numerical Value within Input limits
(4) LO OUT - Analog Variable, Numerical Value within PP limits
(5) HI OUT - Analog Variable, Numerical Value within PP limits

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

SCALE INPUT
AI AO PP CN NUMERIC

INPUT LOW LIMIT
AI AO PP CN NUMERIC

INPUT HIGH LIMIT
AI AO PP CN NUMERIC

OUTPUT LOW LIMIT
AI AO PP CN NUMERIC

OUTPUT HIGH LIMIT
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

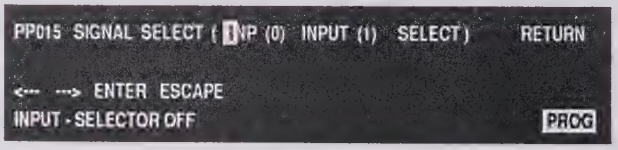
2. **SIGNAL SELECTOR** ANALOG OUTPUT

SIGNAL SEL (INPUT (0), INPUT (1), DISCRETE SELECT)
(1) (2) (3)

If the Select input (discrete) is 0 (OFF), the output of the function is equal to the 1st listed input. If the Select input is 1 (ON), the output of the function is equal to the second listed input. An analog data switch. Output clamped within PP limits.

(1) INPUT (0) - Analog Variable, Numerical Value within PP limits
(2) INPUT (1) - Analog Variable, Numerical Value within PP limits
(3) SELECT - Any Discrete Variable

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

INPUT – SELECTOR OFF
AI AO PP CN NUMERIC

INPUT – SELECTOR ON
AI AO PP CN NUMERIC

SELECT
DI DO PD

Pseudo Point Prepared Functions (Con't)

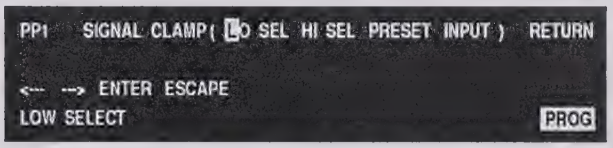
3. SIGNAL CLAMP WITH LIMITS ANALOG OUTPUT

SIGNAL CLAMP (LO SELECT, HI SELECT, PRESET, INPUT)
(1) (2) (3) (4)

If input is between LO SELECT and HI SELECT values, the output equals the input. If the input exceeds the HI or LO SELECT inputs, then the output assumes the preset value.
Output clamped within PP limits.

(1) LO SELECT - Analog Variable, Numerical Value within PP limits
(2) HI SELECT - Analog Variable, Numerical Value within PP limits
(3) PRESET - Analog Variable, Numerical Value within PP limits
(4) INPUT - Analog Variable

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

LOW SELECT
AI AO PP CN NUMERIC

HIGH SELECT
AI AO PP CN NUMERIC

PRESET VALUE
AI AO PP CN NUMERIC

INPUT POINT
AI AO PP CN

Pseudo Point Prepared Functions (Con't)

4. LOW (MIN) SIGNAL SELECT ANALOG OUTPUT

SELECT MIN (INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT
(1) (2) (3) (4) (5) (6) (7) (8) (9)

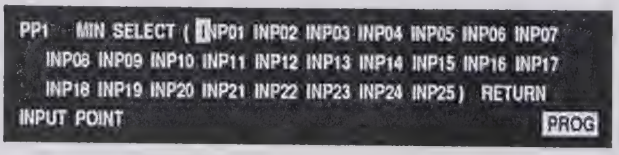
INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT,
(10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20)

INPUT, INPUT, INPUT, INPUT, INPUT
(21) (22) (23) (24) (25)

The output of the function is equal to the lowest or minimum value of the 25 inputs. Unused inputs do not affect the output of the function.

(1) INPUT - Analog Variable, Numerical Value
(2) INPUT - Analog Variable, Numerical Value
(3) INPUT - Analog Variable, Numerical Value or blank
(4) INPUT - Analog Variable, Numerical Value or blank
(5) INPUT - Analog Variable, Numerical Value or blank
(6) INPUT - Analog Variable, Numerical Value or blank
(7) INPUT - Analog Variable, Numerical Value or blank
(8) INPUT - Analog Variable, Numerical Value or blank
(9) INPUT - Analog Variable, Numerical Value or blank
(10) INPUT - Analog Variable, Numerical Value or blank
(11) INPUT - Analog Variable, Numerical Value or blank
(12) INPUT - Analog Variable, Numerical Value or blank
(13) INPUT - Analog Variable, Numerical Value or blank
(14) INPUT - Analog Variable, Numerical Value or blank
(15) INPUT - Analog Variable, Numerical Value or blank
(16) INPUT - Analog Variable, Numerical Value or blank
(17) INPUT - Analog Variable, Numerical Value or blank
(18) INPUT - Analog Variable, Numerical Value or blank
(19) INPUT - Analog Variable, Numerical Value or blank
(20) INPUT - Analog Variable, Numerical Value or blank
(21) INPUT - Analog Variable, Numerical Value or blank
(22) INPUT - Analog Variable, Numerical Value or blank
(23) INPUT - Analog Variable, Numerical Value or blank
(24) INPUT - Analog Variable, Numerical Value or blank
(25) INPUT - Analog Variable, Numerical Value or blank

SPEEDOMAX 25000 DISPLAY:


PP1 MIN SELECT (INP01 INP02 INP03 INP04 INP05 INP06 INP07
INP08 INP09 INP10 INP11 INP12 INP13 INP14 INP15 INP16 INP17
INP18 INP19 INP20 INP21 INP22 INP23 INP24 INP25) RETURN
INPUT POINT
PROG

EDIT MENU Selections:

FOR INPUT 01 THROUGH INPUT 25:
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

5. **HIGH (MAX) SIGNAL SELECT** ANALOG OUTPUT

SELECT MAX (INPUT, (1) INPUT, (2) INPUT, (3) INPUT, (4) INPUT, (5) INPUT, (6) INPUT, (7) INPUT, (8)

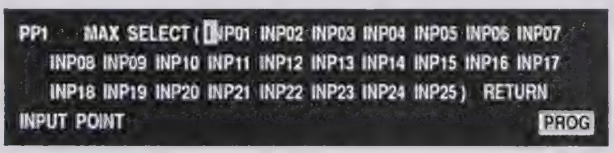
INPUT, (9) INPUT, (10) INPUT, (11) INPUT, (12) INPUT, (13) INPUT, (14) INPUT, (15) INPUT, (16) INPUT, (17) INPUT, (18)

INPUT, (19) INPUT, (20) INPUT, (21) INPUT, (22) INPUT, (23) INPUT, (24) INPUT) (25)

The output of the function is equal to the highest or maximum value of the 25 inputs. Unused inputs do not affect the output of the function.

(1) INPUT - Analog Variable, Numerical Value
(2) INPUT - Analog Variable, Numerical Value
(3) INPUT - Analog Variable, Numerical Value or blank
(4) INPUT - Analog Variable, Numerical Value or blank
(5) INPUT - Analog Variable, Numerical Value or blank
(6) INPUT - Analog Variable, Numerical Value or blank
(7) INPUT - Analog Variable, Numerical Value or blank
(8) INPUT - Analog Variable, Numerical Value or blank
(9) INPUT - Analog Variable, Numerical Value or blank
(10) INPUT - Analog Variable, Numerical Value or blank
(11) INPUT - Analog Variable, Numerical Value or blank
(12) INPUT - Analog Variable, Numerical Value or blank
(13) INPUT - Analog Variable, Numerical Value or blank
(14) INPUT - Analog Variable, Numerical Value or blank
(15) INPUT - Analog Variable, Numerical Value or blank
(16) INPUT - Analog Variable, Numerical Value or blank
(17) INPUT - Analog Variable, Numerical Value or blank
(18) INPUT - Analog Variable, Numerical Value or blank
(19) INPUT - Analog Variable, Numerical Value or blank
(20) INPUT - Analog Variable, Numerical Value or blank
(21) INPUT - Analog Variable, Numerical Value or blank
(22) INPUT - Analog Variable, Numerical Value or blank
(23) INPUT - Analog Variable, Numerical Value or blank
(24) INPUT - Analog Variable, Numerical Value or blank
(25) INPUT - Analog Variable, Numerical Value or blank

SPEEDOMAX 25000 DISPLAY:


PP1 MAX SELECT(INP01 INP02 INP03 INP04 INP05 INP06 INP07
INP08 INP09 INP10 INP11 INP12 INP13 INP14 INP15 INP16 INP17
INP18 INP19 INP20 INP21 INP22 INP23 INP24 INP25) RETURN
INPUT POINT
PROG

EDIT MENU Selections:

FOR INPUT 01 THROUGH 25:
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

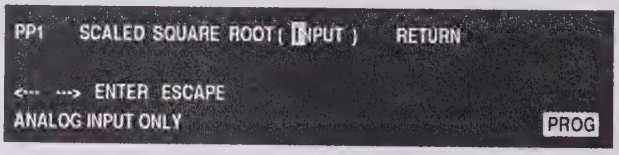
6. SCALED SQUARE ROOT — ANALOG OUTPUT

SCALED SQ RT (INPUT)
(1)

Converts the input to 0 to 1 based upon the limits of the input variable. Then takes the square root of the resulting fraction. This result is then rescaled to engineering units based on the original input limits.

(1) INPUT - Analog Input only

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

ANALOG INPUT ONLY
AI only

7. SINGLE INPUT TIME AVERAGE

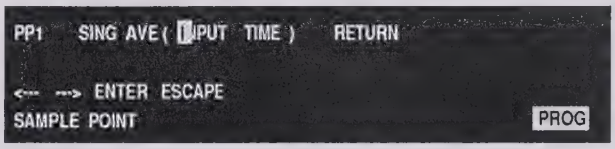
ANALOG OUTPUT

SING IN AVE (INPUT, TIME)
(1) (2)

The output is a current moving average of the input over the last specified time period.
The average is calculated from 10 samples equally divided over the time period. If a longer time period is specified, the sample interval will be longer. In between samples,
the output of the function is assumed steady.

(1) INPUT - Analog Variable
(2) TIME - Numerical Value in seconds (100 to 3600 sec)

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

SAMPLE POINT
AI AO PP CN

TIME PERIOD
NUMERIC

Pseudo Point Prepared Functions (Con't)

8. **MULTIPLE INPUT AVERAGE** ANALOG OUTPUT

MULT IN AVE (INPUT, (1) INPUT, (2) INPUT, (3) INPUT, (4) INPUT, (5) INPUT, (6) INPUT, (7) INPUT, (8)

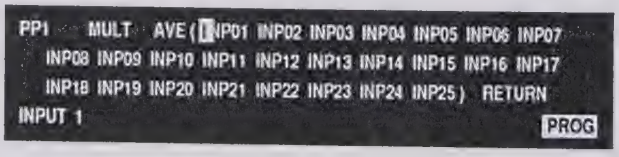
INPUT, (9) INPUT, (10) INPUT, (11) INPUT, (12) INPUT, (13) INPUT, (14) INPUT, (15) INPUT, (16) INPUT, (17) INPUT (18)

INPUT, (19) INPUT, (20) INPUT, (21) INPUT, (22) INPUT, (23) INPUT, (24) INPUT) (25)

The output of the function is equal to the average value of whichever of the 25 inputs are used. This is a continuous real time average.

(1) INPUT - Analog Variable, Numerical Value
(2) INPUT - Analog Variable, Numerical Value
(3) INPUT - Analog Variable, Numerical Value or blank
(4) INPUT - Analog Variable, Numerical Value or blank
(5) INPUT - Analog Variable, Numerical Value or blank
(6) INPUT - Analog Variable, Numerical Value or blank
(7) INPUT - Analog Variable, Numerical Value or blank
(8) INPUT - Analog Variable, Numerical Value or blank
(9) INPUT - Analog Variable, Numerical Value or blank
(10) INPUT - Analog Variable, Numerical Value or blank
(11) INPUT - Analog Variable, Numerical Value or blank
(12) INPUT - Analog Variable, Numerical Value or blank
(13) INPUT - Analog Variable, Numerical Value or blank
(14) INPUT - Analog Variable, Numerical Value or blank
(15) INPUT - Analog Variable, Numerical Value or blank
(16) INPUT - Analog Variable, Numerical Value or blank
(17) INPUT - Analog Variable, Numerical Value or blank
(18) INPUT - Analog Variable, Numerical Value or blank
(19) INPUT - Analog Variable, Numerical Value or blank
(20) INPUT - Analog Variable, Numerical Value or blank
(21) INPUT - Analog Variable, Numerical Value or blank
(22) INPUT - Analog Variable, Numerical Value or blank
(23) INPUT - Analog Variable, Numerical Value or blank
(24) INPUT - Analog Variable, Numerical Value or blank
(25) INPUT - Analog Variable, Numerical Value or blank

SPEEDOMAX 25000 DISPLAY:


PP1 MULT AVE (INP01 INP02 INP03 INP04 INP05 INP06 INP07
INP08 INP09 INP10 INP11 INP12 INP13 INP14 INP15 INP16 INP17
INP18 INP19 INP20 INP21 INP22 INP23 INP24 INP25) RETURN
INPUT 1
PROG

EDIT MENU Selections:

FOR INPUT 01 THROUGH 25:
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

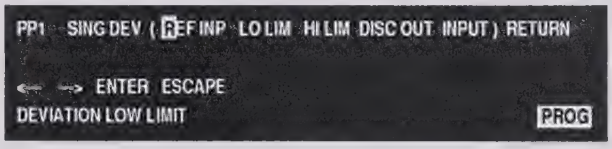
9. SINGLE INPUT DEVIATION DISCRETE OUTPUT (PP Limits Not Used)

SING IN DEV (REF INP, LO LIM, HI LIM, OUTPUT DISCRETE, INPUT)
(1) (2) (3) (4) (5)

If input is not between (REF INPUT + LO LIMIT) and (REF INPUT + HI LIMIT), the function output is 1. If input is between these two values, the function output is 0. The function output may be optionally assigned to a discrete element. Same as #10 except only 1 input is used.

(1) REF INPUT - Analog Variable, Numerical Value
(2) LO LIMIT - Analog Variable, Numerical Value
(3) HI LIMIT - Analog Variable, Numerical Value
(4) OUTPUT DISCRETE - DO or blank
(5) INPUT - Analog Variable

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

REFERENCE VALUE
AI AO PP CN NUMERIC

DEVIATION LOW LIMIT
AI AO PP CN NUMERIC

DEVIATION HIGH LIMIT
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

INPUT POINT
AI AO PP CN

Pseudo Point Prepared Functions (Con't)

10. **MULTIPLE INPUT DEVIATION** DISCRETE OUTPUT (PP Limits Not Used)

MULT IN DEV (REF INP, LOW LIM, HI LIM, OUTPUT DISCRETE, INPUT, INPUT,
(1) (2) (3) (4) (5) (6)

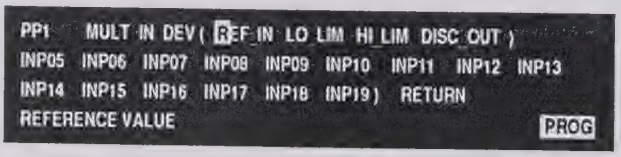
INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT, INPUT,
(7) (8) (9) (10) (11) (12) (13) (14) (15) (16)

INPUT, INPUT, INPUT)
(17) (18) (19)

If any input is not between (REF INPUT + LO LIMIT) and (REF INPUT + HI LIMIT), the function output is 1. If all inputs are between these two values, the function output is 0. The function output may be optionally assigned to a discrete element. Any number of inputs (1 to 15) may be used.

(1) REF INPUT - Analog Variable, Numerical Value
(2) LO LIMIT - Analog Variable, Numerical Value
(3) HI LIMIT - Analog Variable, Numerical Value
(4) OUTPUT DISCRETE - DO or blank
(5) INPUT - Analog Variable
(6) INPUT - Analog Variable or blank
(7) INPUT - Analog Variable or blank
(8) INPUT - Analog Variable or blank
(9) INPUT - Analog Variable or blank
(10) INPUT - Analog Variable or blank
(11) INPUT - Analog Variable or blank
(12) INPUT - Analog Variable or blank
(13) INPUT - Analog Variable or blank
(14) INPUT - Analog Variable or blank
(15) INPUT - Analog Variable or blank
(16) INPUT - Analog Variable or blank
(17) INPUT - Analog Variable or blank
(18) INPUT - Analog Variable or blank
(19) INPUT - Analog Variable or blank

SPEEDOMAX 25000 DISPLAY:


PP1 MULT IN DEV (REF IN LO LIM HI LIM DISC OUT)
INP05 INP06 INP07 INP08 INP09 INP10 INP11 INP12 INP13
INP14 INP15 INP16 INP17 INP18 INP19) RETURN
REFERENCE VALUE
PROG

EDIT MENU Selections:

REFERENCE INPUT
AI AO PP CN NUMERIC

DEVIATION LOW LIMIT
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

DEVIATION HIGH LIMIT
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

INPUT 06 THROUGH 19
AI AO PP CN CLEAR

11. TOTALIZATION - HOURS ANALOG OUTPUT
DISCRETE OUTPUT

TOTL HRS (INPUT, PRESET, RESET DISCRETE, OUTPUT DISCRETE)
(1) (2) (3) (4)

The input is assumed to be in eng units/hr. and is assumed to be constant between measurements. At each measurement time the appropriate increment is added to the running total. When this total reaches the preset number (assumed to be in eng units),the discrete output of the function goes high & remains high for 1 measurement cycle. The totalizer resets and starts again. The value resets to either zero or the residual total (final total - preset) if one exists. The analog output of the function is the actual instantaneous total. The discrete output of the function may optionally be directly assigned to a discrete element. Also an optional discrete input may be used to reset the count to zero at any time.

(1) INPUT - Analog Variable
(2) PRESET - Analog Variable, Numerical Value 1 to 999999
(3) RESET DISCRETE - Any Discrete Variable or blank
(4) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:

416

EDIT MENU Selections:
INPUT POINT
AI AO PP CN

PRESET VALUE
AI AO PP CN NUMERIC

RESET SWITCH
DI DO PD CLEAR

OPTIONAL DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

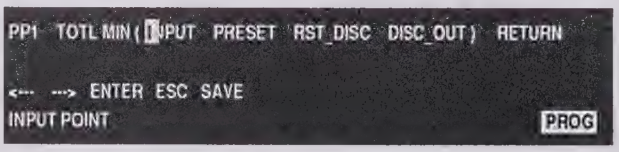
12. TOTALIZATION - MINUTES ANALOG OUTPUT
DISCRETE OUTPUT

TOTL MIN (INPUT, PRESET, RESET DISCRETE, OUTPUT DISCRETE)
(1) (2) (3) (4)

Same as #11 except that the input is assumed to be eng units/minute.

(1) INPUT - Analog Variable
(2) PRESET - Analog Variable, Numerical Value 1 to 999999
(3) RESET DISCRETE - Any Discrete Variable or blank
(4) OUTPUT DISCRETE - DO,or blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

INPUT POINT
AI AO PP CN

PRESET VALUE
AI AO PP CN NUMERIC

RESET SWITCH
DI DO PD CLEAR

OPTIONAL DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

13. MASS FLOW W/SQUARE ROOT ANALOG OUTPUT

MASS FL (dP INPUT, PRESS INPUT, TEMP INPUT, FACTOR 1)
(1) (2) (3) (4)

Mass flow is calculated from the following formula:

$$MF = FACTOR\ 1 \times \sqrt{\frac{dP\ INPUT \times (PRESS.\ INPUT + 14.7}{(TEMP\ INPUT + 459)}}$$

FACTOR 1 is calculated by the user using reference conditions for the orifice plate.
dP is differential pressure in inches of water (W.C.).
Pressure input is in PSIG
Temp is in deg F.

(1) dP INPUT - Analog Variable
(2) PRESS INPUT - Analog Variable
(3) TEMP INPUT - Analog Variable
(4) FACTOR 1 – Analog Variable or Numerical Value.

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

DIFF PRESS INPUT
AI AO PP CN

PRESSURE INPUT
AI AO PP CN

TEMPERATURE INPUT
AI AO PP CN

FACTOR 1 INPUT
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

14. **PRESSURE COMPENSATED DRUM LEVEL** ANALOG OUTPUT

DRUM LEVEL (LEVEL INPUT, PRESSURE INPUT)
(1) (2)

The output is calculated according to the following formula:

$$\text{OUTPUT} = \frac{101 - (5.43 \times 10^{-3} \times \text{PRESSURE INPUT}) - \text{LEVEL INPUT}}{0.88 - (.173 \times 10^{-3} \times \text{PRESSURE INPUT})}$$

where: output is 0 to 100%
level input is level differential in percent of transmitter range (0-100)
Pressure input is the drum pressure in PSIA

(1) LEVEL INPUT - Analog Variable
(2) PRESSURE INPUT - Analog Variable, Numerical Value

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

LEVEL INPUT
AI AO PP CN

PRESSURE INPUT
AI AO PP CN NUMERIC

Pseudo Point Prepared Functions (Con't)

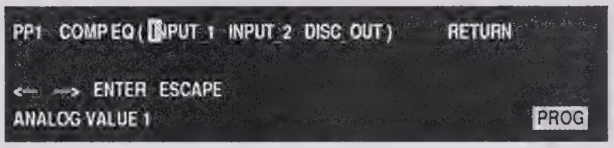
15. COMPARE, EQUAL DISCRETE OUTPUT

COMPARE EQ (INPUT, INPUT, OUTPUT DISCRETE)
(1) (2) (3)

Output of function is 1 when the two inputs are equal,otherwise the output is 0. Output may optionally be directly assigned to a discrete element.

(1) INPUT - Analog Variable, Numerical Value
(2) INPUT - Analog Variable, Numerical Value
(3) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

ANALOG VALUE 1
AI AO PP CN NUMERIC

ANALOG VALUE 2
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

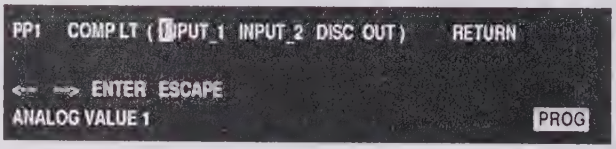
16. **COMPARE, LESS THAN** DISCRETE OUTPUT

COMPARE LT (INPUT 1, INPUT 2, OUTPUT DISCRETE)
(1) (2) (3)

Output of function is 1 when input 1 < input 2. Otherwise the output is 0. Output may optionally be directly assigned to a discrete element.

(1) INPUT 1 - Analog Variable, Numerical Value
(2) INPUT 2 - Analog Variable, Numerical Value
(3) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

ANALOG VALUE 1
AI AO PP CN NUMERIC

ANALOG VALUE 2
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

17. **COMPARE, GREATER THAN** DISCRETE OUTPUT

COMPARE GT (INPUT 1, INPUT 2, OUTPUT DISCRETE)
(1) (2) (3)

Output of function is 1 when input 1 > input 2. Otherwise the output is 0. Output may optionally be directly assigned to a discrete element.

(1) INPUT 1 - Analog Variable, Numerical Value
(2) INPUT 2 - Analog Variable, Numerical Value
(3) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:

Pseudo Point Prepared Functions (Con't)

EDIT MENU Selections:

ANALOG VALUE 1
AI AO PP CN NUMERIC

ANALOG VALUE 2
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

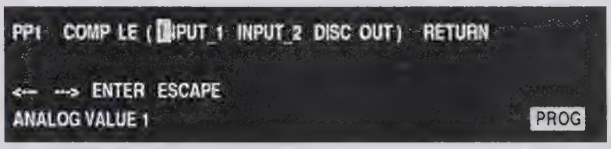
18. COMPARE, LESS OR EQUAL — DISCRETE OUTPUT

COMPARE LE (INPUT 1, INPUT 2, OUTPUT DISCRETE)
(1) (2) (3)

Output of function is 1 when input 1 ≤ input 2. Otherwise the output is 0. Output may optionally be directly assigned to a discrete element.

(1) INPUT 1 - Analog Variable, Numerical Value
(2) INPUT 2 - Analog Variable, Numerical Value
(3) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

ANALOG VALUE 1
AI AO PP CN NUMERIC

ANALOG VALUE 2
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

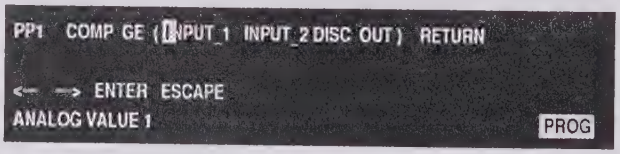
19. COMPARE, GREATER OR EQUAL DISCRETE OUTPUT

COMPARE GE (INPUT 1, INPUT 2, OUTPUT DISCRETE)
(1) (2) (3)

Output of function is 1 when input 1 ≥ input 2. Otherwise the output is 0. Output may optionally be directly assigned to a discrete element.

(1) INPUT 1 - Analog Variable, Numerical Value
(2) INPUT 2 - Analog Variable, Numerical Value
(3) OUTPUT DISCRETE - DO or blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

ANALOG VALUE 1
AI AO PP CN NUMERIC

ANALOG VALUE 2
AI AO PP CN NUMERIC

OPTIONAL DISCRETE OUTPUT
DO CLEAR

20. TIME COMPARISON DISCRETE OUTPUT

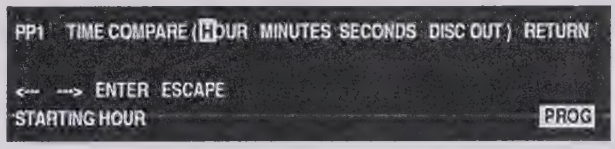
TIME COMPARE (HRS, MIN, SEC, DISCRETE OUTPUT)
(1) (2) (3) (4)

The output is 0 as long as the time of day is less (earlier) than the time represented by the inputs. When the actual time is equal to or greater (later) than the preset time, the output goes high (1) for one complete machine cycle. The output may optionally be assigned directly to a discrete element.

(1) HRS - Numerical value or CN. Limit (0 to 23)
(2) MIN - Numerical value or CN. Limit (0 to 59)
(3) SEC - Numerical value or CN. Limit (0 to 59)
(4) DISCRETE OUTPUT - DO or blank

Pseudo Point Prepared Functions (Con't)

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

STARTING HOUR
NUMERIC OR CN (Limit 0-23)

STARTING MINUTES
NUMERIC OR CN (Limit 0-59)

STARTING SECONDS
NUMERIC OR CN (Limit 0-59)

OPTIONAL DISCRETE OUTPUT
DO CLEAR

21. LOGIC "AND" DISCRETE OUTPUT

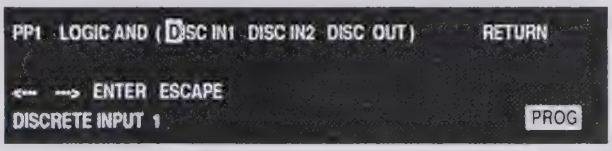
LOGIC AND (DISCRETE INPUT 1, DISCRETE INPUT 2, DISCRETE OUTPUT)
(1) (2) (3)

Function output is DISC INPUT 1 "AND" DISC INPUT 2.

The value of the output may optionally be directly assigned to an output discrete.

(1) DISCRETE INPUT 1 - Any Discrete Variable
(2) DISCRETE INPUT 2 - Any Discrete Variable
(3) DISCRETE OUTPUT - DO or Blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:
DISCRETE INPUT 1
DI DO PD

DISCRETE INPUT 2
DI DO PD

OPTIONAL DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

22. **LOGIC "OR"** DISCRETE OUTPUT

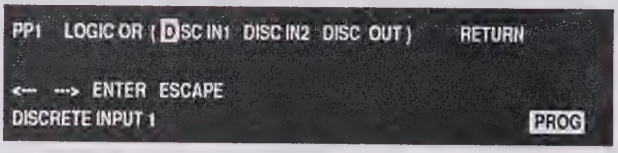
LOGIC OR (DISCRETE INPUT 1, DISCRETE INPUT 2, DISCRETE OUTPUT)
(1) (2) (3)

Function output is DISC INPUT 1 "OR" DISC INPUT 2.

The value of the output may optionally be directly assigned to an output discrete.

(1) DISCRETE INPUT 1 - Any Discrete Variable
(2) DISCRETE INPUT 2 - Any Discrete Variable
(3) DISCRETE OUTPUT - DO or Blank

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

DISCRETE INPUT 1
DI DO PD

DISCRETE INPUT 2
DI DO PD

OPTIONAL DISCRETE OUTPUT
DO CLEAR

23. **LOGIC "EXC OR"** DISCRETE OUTPUT

LOGIC XOR (DISCRETE INPUT 1, DISCRETE INPUT 2, DISCRETE OUTPUT)
(1) (2) (3)

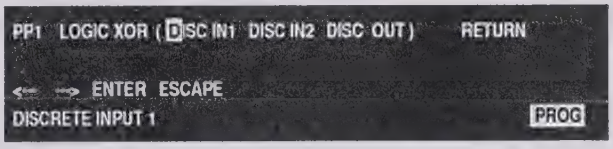
Function output is DISC INPUT 1 "EXC OR" DISC INPUT 2.

The value of the output may optionally be directly assigned to an output discrete.

(1) DISCRETE INPUT 1 - Any Discrete Variable
(2) DISCRETE INPUT 2 - Any Discrete Variable
(3) DISCRETE OUTPUT - DO or Blank

Pseudo Point Prepared Functions (Con't)

SPEEDOMAX 25000 DISPLAY:



EDIT MENU Selections:

DISCRETE INPUT 1
DI DO PD

DISCRETE INPUT 2
DI DO PD

OPTIONAL DISCRETE OUTPUT
DO CLEAR

24. LOGIC "NOT" DISCRETE OUTPUT

LOGIC NOT (DISCRETE INPUT, DISCRETE OUTPUT)
(1) (2)

The output is the logical inversion of the input. The output may optionally be directly assigned to a discrete element.

(1) DISCRETE INPUT - Any Discrete Variable
(2) DISCRETE OUTPUT - DO or Blank

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

DISCRETE INPUT 1
DI DO PD

DISCRETE OUTPUT
DO CLEAR

Pseudo Point Prepared Functions (Con't)

25. PEAK PICKING - HI PEAKS — ANALOG OUTPUT

HI PEAK (INPUT, TIME)
(1) (2)

The function monitors the input and remembers the highest value reached during the specified time interval (in seconds). At the end of the time frame, the output steps to the value of the peak and holds this value until the end of the next time interval.

(1) INPUT - Analog Variable
(2) TIME - Numerical Value 1 to 900 (seconds)

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

SAMPLE POINT
AI AO PP CN

SAMPLE TIME
NUMERIC

26. PEAK PICKING - LO PEAKS — ANALOG OUTPUT

LO PEAK (INPUT, TIME)
(1) (2)

The function monitors the input and remembers the lowest value reached during the specified time interval (in seconds). At the end of the timeframe, the output steps to the value of the peak and holds this value until the end of the next time interval.

(1) INPUT - Analog Variable
(2) TIME - Numerical Value 1 to 900 (seconds)

SPEEDOMAX 25000 DISPLAY:

Pseudo Point Prepared Functions (Con't)

EDIT MENU Selections:

SAMPLE POINT
AI AO PP CN

SAMPLE TIME
NUMERIC

27. RATE OF CHANGE — ANALOG OUTPUT

RATE CHG (INPUT, SAMPLE, RN/RST)
(1) (2) (3)

(1) INPUT - Any Analog Variable
(2) SAMPLE TIME - A Number (in minutes) or Analog Variable ≥ 0.1
(3) RUN/RESET - Any Discrete Variable

$$\text{OUTPUT} = \frac{\text{INPUT} - \text{LAST INPUT}}{\text{SAMPLE TIME}}$$

The reset line is normally held low (0) to run. If it goes high (1), the output will be held at its last value and the sample rate clock will be reset to 0.

SPEEDOMAX 25000 DISPLAY:

EDIT MENU Selections:

INPUT POINT
AI AO PP CN

SAMPLE RATE
AI AO PP CN NUMERIC

RUN/RESET SWITCH
DI DO PD

6. Programming

CONFIGURING GROUPS

This section describes procedures for establishing groups of data points. A group may contain up to 30 data points. An individual group may contain only one type of data, either all analog or all discrete.

ANALOG GROUP PROGRAMMING

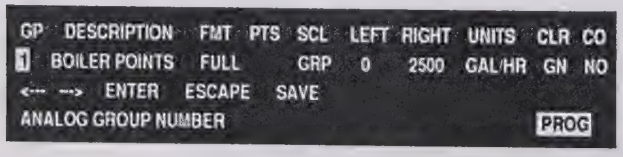
Analog group programming involves specifying what points are to be in the group, a description for the group, and the format in which it is to appear when printed as a group trend. This includes selection of full or split scale format, chart scale limits, units of measure, and a group color.

All data points must belong to a group. For first-time programming, it should be noted that factory-set default programming assigns I/O points to groups according to the particular circuit cards installed in the Recorder (see "General Procedure" at the beginning of this programming section).

Follow instructions in this section to reassign data points to groups as you prefer.

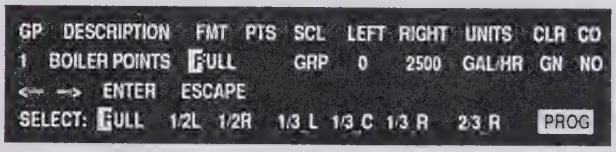
1. From the top level programming display, cursor to GROUP and press **ENTER**. The display will show Group 1. If Group 1 has not been programmed already (either by the programmer or by default setting of the SPEEDOMAX 25000), a "group unassigned" display will appear. In this case, cursor to GROUP TYPE and press **ENTER**. Then cursor to ANALOG or DISCRETE and press **ENTER** to select the type of group to be programmed.

If Group 1 has already been programmed, the display will show the type of group. If for example, Group 1 was programmed as an Analog Group, the display will show:


GP DESCRIPTION FMT PTS SCL LEFT RIGHT UNITS CLR CO
1 BOILER POINTS FULL GRP 0 2500 GAL/HR GN NO
<-- --> ENTER ESCAPE SAVE
ANALOG GROUP NUMBER
PROG

2. To create a new group or to access a different existing group, cursor to the "NUM" column and press **ENTER** to edit. Key in a number for the group and press **ENTER**. If you are editing an existing group, you may also use the **PG DN** and **PG UP** keys to scroll the number in the "NUM" column to the desired group number. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in a text description for the group to appear on displays and charts (14 characters maximum) and press **ENTER**.

3. Cursor to the "FMT" (Format) column and press **ENTER** to edit. The display will show:


GP DESCRIPTION FMT PTS SCL LEFT RIGHT UNITS CLR CO
1 BOILER POINTS FULL GRP 0 2500 GAL/HR GN NO
<-- --> ENTER ESCAPE
SELECT: FULL 1/2L 1/2R 1/3 L 1/3 C 1/3 R 2/3 R PROG

Four selections of chart format are available for printing trend charts of this group. They are illustrated in Fig. 6-6. Cursor to the desired format selection and press **ENTER**. The previous display will be restored.

For split scale selections, the entire group will be assigned to the zone selected. A zone may contain only one group.

To make the split groups print together as shown in Figure 6-6, the "Multiple Groups Together" selection must be made in the Operation Mode (see "Printing Trend charts" in Section 5). For example, if group 1 is 1/3L, group 2 is 1/3C and group 3 is 1/3R, these three groups (and only these 3) would be selected on this display.

Note that the maximum number of recorded points is 30 points over the full width of the chart, so that a group is limited to 15 points in 1/2 – 1/2 option, 10 points in the 1/3 scale option and 20 points for the 2/3 scale.

5. Cursor to the "PTS" (points) column and press **ENTER** to edit. The display will show analog data point numbers, as in this illustration:

6. Programming

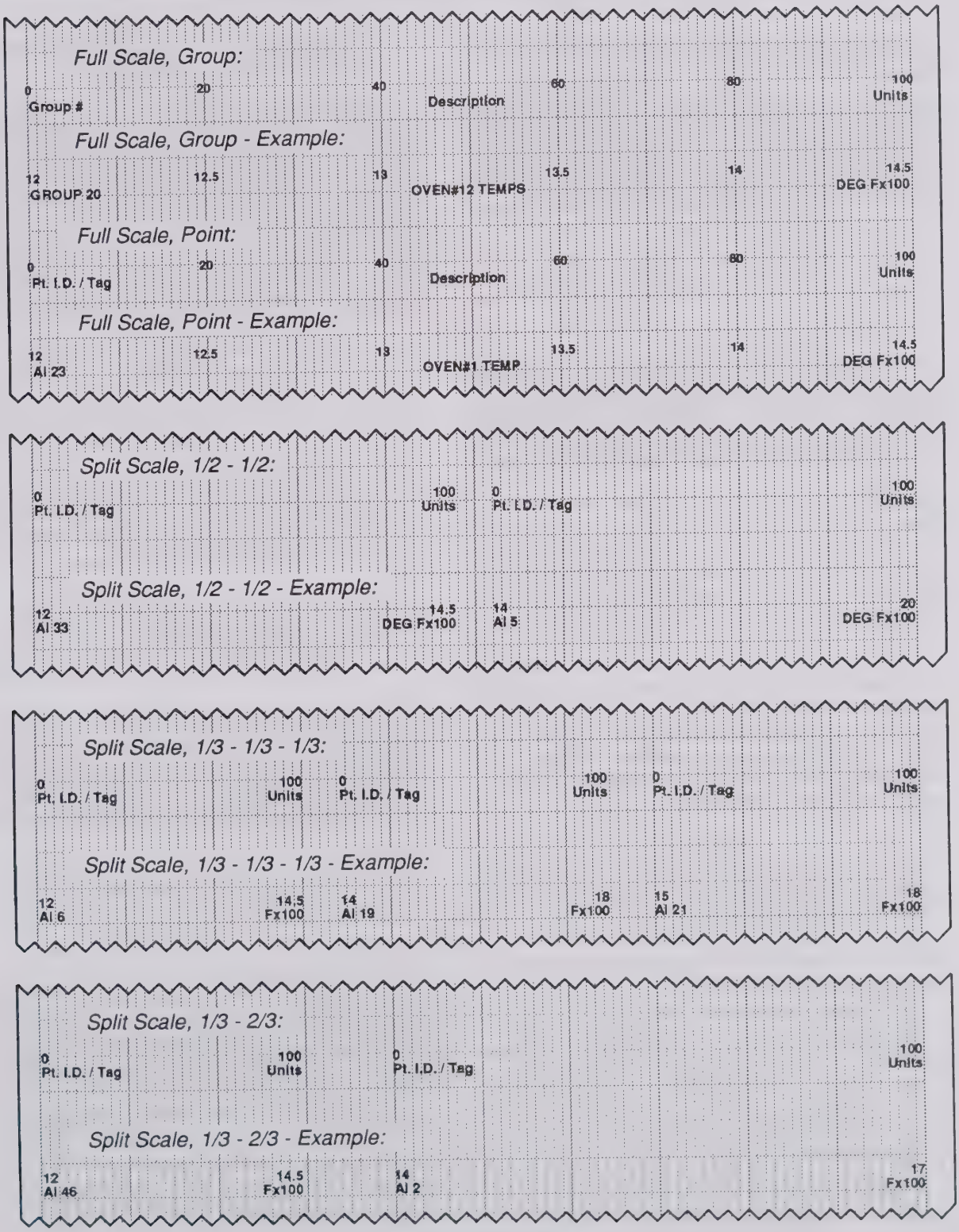
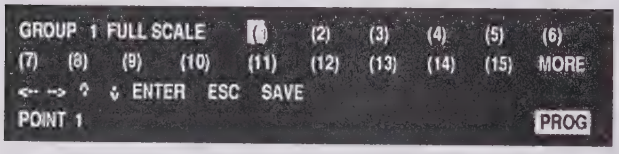


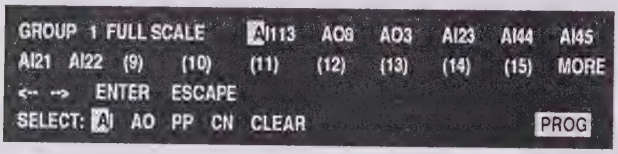
Figure 6-6 Chart Scales

6. Programming

If no points have yet been programmed to the Group, the display would look like this:



To enter a new data point, place the cursor on an unused (numbered) space. To edit an existing point, place the cursor on the desired point. Press **ENTER**. The display will show:



To delete the point, cursor to CLEAR and press **ENTER**. If you are entering a new point, cursor to select the type of analog data point you wish to enter and press **ENTER**. At the prompt ENTER NUMBER, key in the point number and press **ENTER**. The previous display will be restored. The new point will be shown.

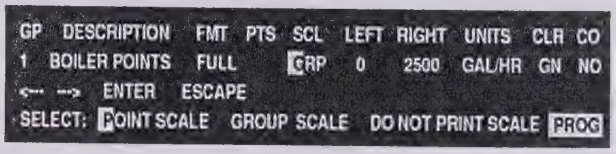
Repeat this procedure to add or edit more points. If more than 15 points are to be entered, cursor to MORE and press **ENTER**. Up to 30 points may be entered in a group, if full scale format has been selected. Half scale will allow entry of no more than 15 points. 1/3 scale formats will allow entry of no more than 10 points, and 2/3 scale will allow 20 points.

CAUTION

Changing a format from "Full" to "Split" results in having the number of points truncated to the valid number of points for that format.

When all points are entered as desired, press **ESC** to restore the previous display.

6. Cursor to the "SCL" (Print Scale) column and press **ENTER** to edit. The display will show:


GP DESCRIPTION FMT PTS SCL LEFT RIGHT UNITS CLR CO
1 BOILER POINTS FULL GRP 0 2500 GAL/HR GN NO
<-- --> ENTER ESCAPE
SELECT: POINT SCALE GROUP SCALE DO NOT PRINT SCALE PROG

Cursor to select the scale type for the chart. Select POINT SCALE to print a scale for each point, one at a time on the chart at programmed intervals. The scales will be those previously programmed for each individual point. Select GROUP SCALE to print one overall scale for all points in the group.

Group Scale is for reference only and applies only to the chart. The display always utilizes point scales.

Press **ENTER**. If you selected POINT SCALE, proceed to the next step (color). If you selected GROUP SCALE, you must now specify the scale by entering the left and right limits and units.

Cursor to the "LEFT" column and press **ENTER** to edit. Key in the numerical value for the left chart limit for the group scale and press **ENTER**. Repeat the procedure to enter the value for the right side limit for the group scale.

7. Cursor to the "UNITS" column and press **ENTER** to edit. Key in a text description of the units of measure to be used for the group scale and press **ENTER**. This is a descriptor which will appear on charts.

8. Cursor to the "CLR" (color) column and press **ENTER** to edit. Cursor to select a common group color. Press **ENTER**.

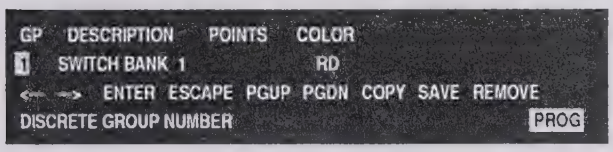
9. Cursor to the "CO" (Color ON) column and press **ENTER** to edit. Cursor to select NO or YES and press **ENTER**. If you select YES, all points in the group will trend in that color. If you select NO, individual points will trend in the color for which each has previously been programmed.

10. Press **SAVE** to save the group configuration. The display will return to the Analog Group display.

6. Programming

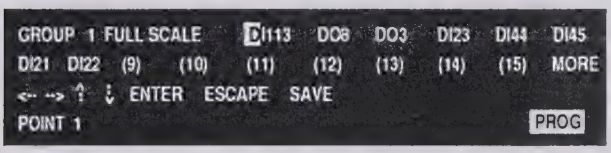
DISCRETE GROUP PROGRAMMING

1. From the top level programming display, cursor to GROUP and press **ENTER**. Cursor to DISCRETE and press **ENTER**. The display will show (if the first group has been programmed as a discrete group):

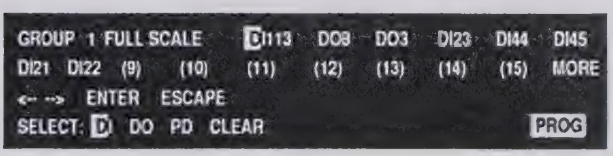


2. To create a new group, or to access a different existing group, cursor to the "GP" column and press **ENTER** to edit. Key in a number for the group and press **ENTER**. If you wish to edit an existing group, you may also use the **PG DN** and **PG UP** keys to scroll the number in the "GP" column to the desired group number. Cursor to the "DESCRIPTION" column and press **ENTER** to edit. Key in a text description for the group to appear on displays and charts (14 characters maximum) and press **ENTER**.

3. Cursor to the "POINTS" (points) column and press **ENTER** to edit. If you are editing an existing group, the display will show discrete data point numbers, as in this illustration:



To enter a new data point, place the cursor on an unused (numbered) space. To edit an existing point, place the cursor on the desired point. Press **ENTER**. The display will show:



4. Cursor to select the type of discrete data point you wish to enter and press **ENTER**. At the prompt ENTER NUMBER, key in the point number and press **ENTER**. The previous display will be restored. The new point will be shown, or the edited point replaced with the new one.

5. Repeat this procedure to add or edit more points. If more than 15 points are to be entered, cursor to MORE and press **ENTER**. Up to 30 points may be entered in a group.

6. When all points are entered as desired, press **ESC** to restore the previous display.

7. Cursor to the "COLOR" column and press **ENTER** to edit. Cursor to select a common group color for datalog printouts. Press **ENTER**.

8. Press **SAVE** to save the group configuration. The display will return to the Discrete Group display.

6. Programming

CONFIGURING ALARMS

GENERAL

SPEEDOMAX 25000 alarms may be programmed in three ways:

1. By designating a DI as an alarm.
   See "Discrete Input Programming".

2. By designating a DO as an alarm.
   See Discrete Output Programming".

3. By programming an Alarm Level (AL) which triggers a DO.

The first two ways of creating alarms are described in the respective programming procedures for DI and DO. This section describes alarm level programming.

From the top level programming display, cursor to ALARM and press **ENTER**. Cursor to ALARM LEVEL and press **ENTER**. The display will show (this example is for a previously programmed alarm level):

LEV POINT SETPT HYST ACTION COMPARE DO LINK
120 AI120 1234.6 1.5000 DEV AI101 DO120 AND
← → ENT ESC PGUP PGDN COPY SAVE REMOVE
ALARM LEVEL NUMBER
PROG

This display is used to program "Alarm Levels". An Alarm Level is a specification which applies to one analog data point only. While an alarm level can refer to only one data point, a data point can have more than one alarm level. For example, Analog Input 1, (AI1), could have Alarm Level 1 (AL1), which specifies a high limit alarm for that data point. AI1 could also have Alarm Level 10 (AL10), which could specify a high rate alarm for the same input.

Entries on this display specify the parameter (data point) to which the alarm level applies, and also the set point, alarm actions, and outputs to occur if the alarm level is exceeded.

ALARM LEVEL PROGRAMMING

1. Cursor to the "LEV" column and press **ENTER** to edit. Key in a 1 to 3 digit number to identify the alarm level, or use the **PG UP** and **PG DN** keys to select. Up to 120 alarm levels may be programmed.

2. Cursor to the "POINT" column and press **ENTER** to edit. Enter a data point to which the alarm level will apply. Select a data point type, press **ENTER**, key in the data point number and press **ENTER**.

3. Cursor to the "SETPT" (Setpoint) column and press **ENTER** to edit. Enter here a value for the alarm setpoint. A numerical value or an analog data point (AI, AO, PP, CN) may be entered. Cursor to select the type, press **ENTER**, key in the number and press **ENTER**.

NOTE

For rate alarms, the setpoint value is in engineering units/minute.

4. Cursor to the "HYST" (hysteresis) column and press **ENTER** to edit. Key in a numerical value for hysteresis (the amount by which the parameter must retreat from the setpoint to deactivate an active alarm) and press **ENTER**. (The numerical value entered is in the same units of measure as the data point.) Enter a value of zero to deactivate this item. The SPEEDOMAX 25000 will then make no check for hysteresis for this alarm level.

5. Cursor to the "ACTION" column and press **ENTER** to edit. Cursor to select the type of alarm action desired and press **ENTER**. The available action choices are as follows:

HIGH	Alarms if data point value exceeds setpoint value.
LOW	Alarms if data point value is less than setpoint value.
HIGH RATE (HI RATE)	Alarms if data point value is increasing at a rate faster than the setpoint value.
LOW RATE (LO RATE)	Alarms if data point value is decreasing at a rate faster than the setpoint value.

DEVIATION (DEV) — Alarms if data point value deviates from the "Compare Point" in either direction by more than the setpoint value.

NO ACTION (NO ACT) — Disables the alarm without removing the programmed alarm level data.

6. If DEVIATION (DEV) was selected as the alarm action, cursor to the "COMPARE" column and press **ENTER** to edit. If DEV was not selected, ignore the "COMPARE" column. In the "COMPARE" column, enter the analog data point (AI, AO, PP, CN) from which the deviation is to be measured. The amount of deviation (higher or lower) to activate the alarm will be the value you entered in the "SETPT" column.

7. Cursor to the "DO" column and press **ENTER** to edit. Enter a number for a discrete output which will be activated if the alarm is activated. Press **ENTER**. A value must be entered here or the alarm level programming will not be permitted. This will automatically change the A/E assignment for the designated DO to "ALARM". See "DO Programming".

NOTE

Descriptor, tag and ON/OFF labels for the designated DO must be programmed separately. See "DO programming".

8. Cursor to the "LINK" column and press **ENTER** to edit. Cursor to select the desired alarm linking (AND or OR) and press **ENTER**. Linking refers to all of the alarm levels which are associated with the particular DO entered in the previous column. If AND is selected, the DO will be activated if all of the alarm levels associated with it are active. If OR is selected, the DO will be activated if any one of the alarm levels is active. When the alarm level is saved, all of the alarm levels linked to the specific DO will be assigned the LINK selection entered here. If only one alarm level is assigned to a particular DO, the LINK selection is ignored.

9. Press **SAVE** to save the Alarm level in SPEEDOMAX 25000 memory. Up to 120 alarm levels may be saved.

NOTE

A DO must be entered in the DO column, or SAVE will not be allowed.

SOFT ALARMS

NOTE

This feature must be used with PROMs of Issue D or later.

The Soft Alarms feature allows the user to assign unused Discrete Output (DO) positions as outputs for Alarm Levels without actually having a Discrete Output card installed in the Recorder. These "soft" DO points are automatically created and configured as alarms when the Alarm Level is programmed. Once they have been created through Alarm Level programming, soft DO points can be treated exactly the same as "hardware" DO points, except there is no external alarm indication. The user can assign descriptors, tags, and on/off labels using the DO programming menus. These DOs can be placed in groups for display and/or data logging. Soft DO points can be used singly or in linked arrangements with multiple Alarm Levels. Soft alarm points will be removed only when the associated Alarm Level(s) has been removed. They cannot be removed by using the **REMOVE** function key.

To create a soft alarm, cursor to the "DO" column and enter the number of the Discrete Output which will be activated when the Alarm Level is activated. The "soft" DO will be configured automatically when **SAVE** is pressed.

When a soft alarm is configured, the DO is automatically programmed as a "remote" DO, with the A/E assignment set to "ALARM" (refer to "Discrete Output (DO) Programming" in this section). These assignments are automatically deleted if the Alarm Level is deleted or reassigned.

COMMON ALARM OPTIONS

NOTE

This feature must be used with PROMs of Issue E or later.

The SPEEDOMAX 25000 Recorder allows the assignment of two Common Alarm Discrete Outputs (DO); a lock-in relay common to all alarms and an annunciator relay common to all alarms. The Recorder also allows the assignment of a Discrete Input (DI) which will silence the annunciator relay when the DI contact is closed. The use of any of these features is optional.

6. Programming

In the SPEEDOMAX 25000 Recorder, the term "alarm" refers to:

- Any Discrete Input which has been configured as an Alarm on the Discrete Input Programming Display.
- Any Discrete Output which has been configured as an Alarm on the Discrete Output Programming Display.
- Any Discrete Output which is triggered by an Alarm Level. Note that the transition of individual alarm levels in a "linked" level arrangement will not trigger either the Common Alarm DO or the Annunciator DO; these options are only affected by the state of the DO assigned to the "linked" Alarm Levels.

Common Alarm DO

The DO assigned as the Common Alarm will be energized as long as there are any alarms present in the Recorder. The DO will de-energize when all alarm conditions have cleared. If there is no Discrete Output hardware present, a "soft" DO will be created automatically by the Recorder when the **SAVE** key is pressed.

Annunciator DO

The DO assigned to the Annunciator will be energized whenever any new alarm occurs. The DO will remain energized until one of the following actions occurs:

- All alarms have returned to normal.
- All alarms have been acknowledged by the operator using the **ACKNOWLEDGE** key or the optional Remote Acknowledge DI.
- The optional silence switch is closed.
- All new (unsilenced or unacknowledged) alarms have returned to normal.

If there is no Discrete Output hardware present, a "soft" DO will be created automatically by the Recorder when the **SAVE** key is pressed.

Silence Switch

A Discrete Input may be designated as the silence switch for the Annunciator. The Annunciator DO will de-energize when the silence switch is closed and will remain de-energized until the next new alarm condition is detected. The DI contact must be closed for at least one second in order to be recognized by the Recorder.

Common Alarm Option Configuration

From the top level programming menu, cursor to ALARM and press **ENTER**.

Cursor to COMMON ALARMS and press **ENTER**. The display will show:

Use the following procedure to program the Common Alarm Option.

1. Cursor to the column below each option and press **ENTER**.

2. Cursor to the desired selection (DI/DO or OFF) and press **ENTER**.

3. If either a DI or a DO is selected, enter a number at the prompt and press **ENTER**. The selection will appear on the second line of the display.

4. Press **SAVE** to update the Recorder database.

6. Programming

CONFIGURING SECURITY

SECURITY CODE PROGRAMMING

Two types of security codes, or "passwords," may be utilized for control of access to the SPEEDOMAX 25000. One is for normal operation and restricts certain activities performed by means of the operator's keyboard on the front panel. The second is a programming code, which restricts programming activities performed with the programmer's keyboard.

To utilize this feature, enter your own codes as a part of the programming process. Use the following procedure to assign your own codes.

1. Press any key on the programmer's keyboard to enter Recorder Control Mode. The display will show:

2. Cursor to highlight PROG MODE and press **ENTER**. The display will show:

3. If this is the first time you are establishing codes, press **ENTER**. If a security code is already programmed, key it in here (4 characters) for access to the next display. Press **ENTER**.

The display will show:

4. Cursor to SECURITY and press **ENTER**. The display will show:

If codes are already in use, both currently active codes are shown. To enter or revise codes, cursor to each, press **ENTER** to delete the present code and key in the new code. Press **ENTER** after each entry. The new code is saved to SPEEDOMAX 25000 memory when **ENTER** is pressed and is immediately effective. You do not need to press **SAVE**.

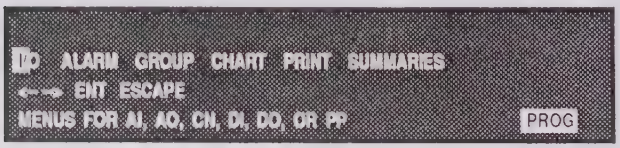
5. Press **ESC** to restore the previous screen. The new codes are effective and should be controlled according to your own procedures. In the event that codes are lost or forgotten, the SPEEDOMAX 25000 includes a security bypass feature. This is described on a separate page of this manual which may be removed for safekeeping. See "Security Bypass Feature".

It should be noted that use of security codes is optional. One or both codes may be used to restrict users as desired. To delete a code, press **ENTER** with the code highlighted as described in previous step 4. With no code entered, access will be unrestricted. Just press **ENTER** when a code is requested and the desired menus will appear.

6. Programming

CONFIGURING CHART AND PRINT FUNCTIONS

A number of programming selections are available for controlling the operation of the chart and selecting types of information to be printed. They are divided into two programming categories which are shown on the second level programming display; CHART and PRINT. This display is accessed by selecting PROG after entering the programming security code:



The selections available in CHART include setting high or low chart speeds, specifying the frequency of printing of chart scales and annotations, and designating discrete data points for remote operation of the chart drive.

The selections available in PRINT include specifying Point or Tag Mode for overall data point identification (including both chart and display), and selecting the type of data to be printed in left margin summary reports and in right margin exception reports.

Program the two categories as follows:

CHART PROGRAMMING

1. On the programming display illustrated above, cursor to CHART and press **ENTER**. The display will show:

2. Select two chart speeds for the operator to choose between. Speeds may be from 1 - 200 cm/HR. With LO in the "CHART SPEED" column highlighted, press **ENTER** to edit. At the prompt, enter a numerical value for the low chart speed, in cm/hr. Press **ENTER**. Cursor to HI in the "CHART SPEED" column and enter a value for the high chart speed in the same manner.

3. Cursor to the "CLEERTREND" column and press **ENTER** to edit. CLEERTREND® is a feature which allows control of the frequency of printing of chart annotations to minimize clutter on crowded trend charts.

Key in a numerical value (0.5-20) for the spacing, in cm, between point number or tag annotations which are printed adjacent to each trend line on the chart. Press **ENTER**.

4. Cursor to the "SCALE-RPT" column and press **ENTER** to edit. This selection determines how often scales will be printed on trend charts. Key in a numerical value (2-40) for the spacing, in cm, between chart scales. Press **ENTER**.

5. Cursor to the "REM ON/OFF" column and press **ENTER** to edit. This selection will designate a discrete data point (DI) which will turn the chart drive on or off (descriptor, tag and ON/OFF labels for the DI must be programmed separately – see "DI Programming"). The activated (ON) state of the element will turn the drive ON. Because the remote command and the Operator's command from the SPEEDOMAX 25000 front panel are both operative, either will turn the dr ON. Both must be OFF to turn the drive OFF.

Cursor to select "DI" and press **ENTER**. At the prompt, key in the number of the DI and press **ENTER**.

6. Cursor to the "REM HI-SPD" column and press **ENTER** to edit. This selection provides remote control of chart speed selection (high or low). The activated state of the remote element turns chart speed to HIGH. Program this selection according to the preceding instructions for REM. ON/OFF.

NOTE

Chart speed can also be programmed to switch to high automatically on occurrence of an alarm (see "Options Programming" in this section). High speed can be commanded by this alarm function, by the remote control (REM-HI-SPD) function, or by the keyboard (CHART key). All three must be in ***low*** *speed mode for low chart speed to be possible.*

7. Press the **SAVE** key to save this CHART configuration in SPEEDOMAX 25000 memory. It will replace the previous configuration.

PRINT PROGRAMMING

1. Select PRINT on the programming display and press **ENTER** to edit. The display will show:

PT. NUM./TAG LT. MARG. SUM. RT. MARG. SUM.
POINT NUM. AL SUM. ANA. AL EV DG OP
← → ENT SAVE ESC REMOVE
SELECT POINT NUMBER OR TAG FOR PRINT AND DISPLAY
PROG

2. The first selection specifies whether point numbers or tags will be used as the universal designation to appear on displays and charts to identify data points. Refer to "Data Designations – Selecting Point or Tag Mode" in a previous part of this Programming Section.

NOTE

This selection determines only the identification of points for the operator on charts and displays. Point numbers must still be used in all programming activities to identify data.

3. With the "PT NUM/TAG" column highlighted, press **ENTER** to edit. Cursor to select POINT NUMBER or TAG and press **ENTER**.

4. Cursor to highlight the LT MARG SUM columns and press **ENTER** to edit. This selection determines the type of summary data to be printed at intervals in the chart left margin (see Fig. 5-1).

Cursor to select printout of active alarms, or a summary of analog data point values currently being trended, or both. (The printout interval is not selectable.) Press **ENTER**.

5. Cursor to select RT MARG SUM. and press **ENTER** to edit. This selection determines the type of item to be printed in the right margin of the chart when it occurs (see Figure 5-1). The selections are:

Alarm (AL), event (EV), diagnostic message (DG), and open input (OP). Any or all may be selected. With the cursor highlighting the first selection (AL), press **ENTER**. At the prompt, cursor to select PRINT or DO NOT PRINT and press **ENTER**. The highlight will move to the next item (EV). Repeat the procedure for all four selections. If DO NOT PRINT is selected, that particular item will show "OFF" on the display. Only those chosen for printing will remain. If all are selected, the display would look like this:

PT. NUM./TAG LT. MARG. SUM. RT. MARG. SUM.
POINT NUM. ALARM ANALOG AL EV DG OP
← → ENT SAVE ESC REMOVE
SELECT POINT NUMBER OR TAG FOR PRINT AND DISPLAY
PROG

6. When all entries are made, press **SAVE** to save the PRINT Configuration in the SPEEDOMAX 25000 memory. The previous PRINT configuration will be replaced.

6. Programming

OPTIONS PROGRAMMING

Four additional functions are provided in the "OPTIONS" category:

1. LOG-ON-ALARM: A group may be designated to be printed on the chart when any alarm activates.

2. REMOTE-ACK: A discrete input may be assigned to allow acknowledgment of alarms from a remote source.

   NOTE

   It is recommended that a pushbutton switch be installed to control this function. This is because if the DI is maintained in the ON state, alarms will continue to be acknowledged, one after the other.

3. REMOTE-PT-HOLD: A discrete input may be assigned to activate the point hold function from a remote source.

   Holding the DI in the ON state will continue to keep the point currently displayed in HOLD on both the display and chart. (It will be held on the chart only if it is an analog point.) When the DI returns to OFF state, both the display and chart will resume normal functions.

4. CHART-HISPEED-ON-ALARM: Chart speed can be programmed to switch to high when any alarm occurs. (Chart speed is also controlled by the **CHART** key on the Operator's keyboard and can be controlled by remote signal as described in "Chart Programming." If active, all three of these commands must be in low speed mode to enable low speed chart operation.)

Program these options as follows:

1. From the top level programming display, cursor to OPTIONS and press **ENTER** to edit. The display will show:

2. Cursor to GROUP and press **ENTER**. At the prompt ENTER GROUP NUMBER (1-20), key in the number of the group which you wish to be printed on the chart if an alarm should occur. Press **ENTER**. The display will show the group number, as in this example, and the cursor will advance to the next selection:

LOG-ON-ALARM REMOTE-ACK REMOTE-PT HOLD CHT-HISPEED-ON-ALARM
GROUP 13 OFF OFF NO
← → ENT SAVE ESC
REMOTE ACKNOWLEDGE DI ASSIGNMENT
PROG

3. With the "REMOTE-ACK" column highlighted, press **ENTER** to edit. The display will show:

Cursor to select DI and press **ENTER**. At the prompt, key in the 1 or 2 digit number of the discrete input which will acknowledge an alarm when activated. Press **ENTER**. The display will show your selection, as in this example:

LOG-ON-ALARM REMOTE-ACK REMOTE-PT HOLD CHT-HISPEED-ON-ALARM
GROUP 13 DI 30 OFF NO
← → ENT SAVE ESC
REMOTE POINT HOLD DI ASSIGNMENT
PROG

4. With the "REMOTE-PT-HOLD" column highlighted, press **ENTER** to edit. Enter a DI to activate the point hold feature in the same way as you entered the DI in the previous step.

5. With the "CHT-HISPEED-ON-ALARM" column highlighted, press **ENTER** to edit. Cursor to select YES and press **ENTER**. If any alarm occurs, chart speed will advance to high. (The actual values for chart high and low speeds are programmed separately, as described elsewhere in this section.)

SECTION 7
SERIAL COMMUNICATIONS

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7. Serial Communications

NOTE

This feature must be used with PROMs of Issue E or later.

SPECIFICATIONS

Catalog Number Suffix:
A = 41 Single Port
A = 42 Dual Port

Data Link: RS232 (maximum length, 50 ft.) or RS422/485 (maximum length, 2000 ft. multi-drop) user selectable by jumper(s) on communication card. Remote modem linking via RS232.

Protocol: Modeled after X3.28.

Data Rate: Selectable 1200, 9600, 19.2K Baud.

Parity: Odd, Even, none.

Commands Available: Most operator functions, data read/write, recorder configuration.

Drivers Available: Micromax® Management Station direct RS422 link, Datavue software running on IBM 286/386 AT machines, DEC VAX/VMS using MAXCON Interface, MAX 1.

Components:

078669	Single Port Communications Card
078555	Dual Port Communications Card
078559	2-Wire Terminal Board Interface
078724	Label
277815	Serial Communications Protocol Manual
078730	Mounting Kit

DESCRIPTION

The serial communications feature allows the Recorder to be accessed from a Micromax Management Station, Datavue or a host computer. The Recorder will communicate at a rate of 1200, 9600 or 19.2K baud. The baud rate, unit address and parity are selected at the Recorder from a menu display using the programmer's keyboard. The selection of RS232 vs RS422 communications port is made by a hardware jumper on the communications card. The maximum length of the communications link is 50 feet for RS232 and 2000 feet for RS422.

The interface to the Micromax Management Station is similar to a Micromax Local Processing Unit (LPU). The Recorder must be installed on the main RS422 communications link along with the LPUs. It cannot be connected to an optional Micromax RS422 card. The Management Station is allowed to read all analog and discrete data point values, write constant values and alarm level set points, and force DI and DO points. Due to database sizing restrictions in the Management Station software, the Recorder is limited to a maximum of 60 Analog Inputs.

In addition, these Analog Inputs must be positioned in the four slots in the Recorder and/or the first slot (slot 5) in the Recorder Expansion Unit. Configuration of the Recorder database is not supported by the Management Station.

Datavue will support both RS232 and RS422 communications at 1200, 9600 or 19.2K baud. A modem can also be placed between Datavue and the SPEEDOMAX 25000 Recorder to achieve longer distance communication. If a modem is used, the Recorder must be configured to operate at 1200 baud. Datavue software will allow access to both analog and digital point data. Configuration of the Recorder database is not supported by Datavue.

The host computer can use either RS232 or RS422 link at 1200, 9600 or 19.2K baud. Configuration of the Recorder database over the communication link is supported.

For complete information on communications, see Manual 277815, Serial Communications Protocol, supplied with the Recorder.

7. Serial Communications

There are three red LEDs (Light Emitting Diodes) for each port on the front edge of the printed circuit assembly. They are designated DS1, DS2 and DS3 for Port A and DS4, DS5 and DS6 for Port B. The single port card (078669, Catalog Suffix A = 41) has Port A only. When lit, DS2 and DS5 indicate Transmit Enable (on when on link). DS1 and DS4 when lit, indicate Transmit Data (on when actually transmitting). DS3 and DS6 are on when receiving.

PREPARATION

The communication card, as supplied, is set up for RS422 port and being the last port in the communication link. Read this section completely before performing any of the operations discussed. If you want RS422 port and the card is to be the last port in the communication link, it is not necessary to make any of the changes covered.

There are three jumpers for each port mounted on the card near the front edge, designated W1, W2 and W3 for Port A and W4, W5 and W6 for Port B. The single port card (078669, Catalog Suffix A = 41) has Port A only. These jumpers can be changed by pulling them straight away from the card and remounting them on the appropriate pins.

The communications card is supplied with jumpers W1 and W2 mounted in position 1-2 for Port A being the last port in the communication link. Also, jumpers W4 and W5 are mounted in position 1-2 for Port B being the last port in the communication link. If either (or neither) port is not the last port in the link, move the corresponding jumpers to position 2-3.

The card is also supplied with jumper W3 for Port A and jumper W6 for Port B mounted in position 1-2 for RS422 port. If RS232 port is required for either port, reposition jumper W3 and/or W6 to pins 2-3.

The cards are mounted in a card cage on the inside rear of the Recorder behind a metal card cage cover. See Figure 8-15. Wear a grounded wrist strap when handling the cards. If jumpers require changing, proceed as follows:

1. Loosen the four ¼ 8-32 binding head screws, two at the top of the card cage cover and two at the bottom. Hold the cover by its handle, lift it up and remove it. If the hand-held keyboard is mounted on the cover for storage, you may want to remove it first for convenience.

2. Identify the serial communications card. This can be done as follows: The card slots are numbered from 1 to 4 from the bottom of the Recorder to the top. The terminal boards on the rear of the Recorder are also numbered 1 to 4 from bottom to top. The serial communication card corresponds to the terminal board shown in Figure 7-1.

3. Grasp the card where it is marked "PULL HERE" and pull forward until the card is free of its mounting slots. The card should be laid on a conductive plastic bag. Check its part number. It should be either 078669 for a single port card or 078555 for a dual port card. If not, the wrong card was pulled.

4. Change the jumpers as required and remount the card and cover.

CONNECTIONS

Serial communications connections are made as shown in Figure 7-1.

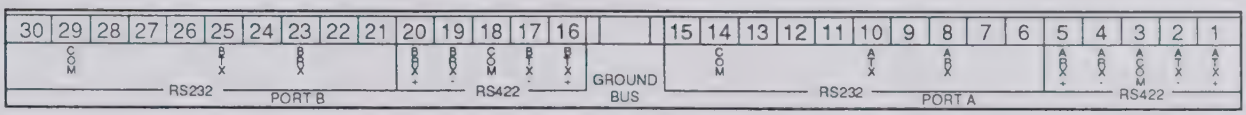

Figure 7-1

7. Serial Communications

PROGRAMMING

After the Recorder has been turned on, connect the programmer's keyboard and select Program Mode. Proceed as follows:

1. Press any key on the programmer's keyboard to enter Recorder Control Mode.

2. Cursor to highlight PROG MODE and press **ENTER**.

3. Key in the security code and press **ENTER**. After successful entry into Program Mode, the display will show:

4. Cursor to highlight PROG and press **ENTER**. The display will show:

5. Cursor to highlight COMM and press **ENTER**.

6. Cursor to each of the fields and make the desired selections. The following limits apply:

UNIT ADDRESS	1 through 254 for normal data transfer, 0 or 255 to de-select this communication port.
BAUD RATE	Select from the menu: 1200, 9600, or 19.2K.
PARITY	Select from the menu: Odd, Even or No Parity.
STATUS	This field is set to SLAVE and is not changeable.
HOST	Select from CUSTOM, DATAVUE or MICROMAX. The host selection allows the Recorder to restrict the use of certain functions based on the type of host computer connected. The CUSTOM and DATAVUE selections can access all available communications functions.

When the desired selections have been made, press **SAVE**. The Recorder will change its database as requested and then reconfigure the hardware on the serial communications card appropriately. It takes the Recorder approximately 4 seconds to perform this SAVE function.

7. Serial Communications

The following errors may be reported during the SAVE.

UNIT ADDRESS LATCH FAILED
The communication card has a writable latch which retains the unit address during operation. This error is generated if the microprocessor on the serial communication card reads a unit address that differs from the value requested by the programmer.

BAUD RATE LATCH FAILED
The communication card also has a writable latch which retains the baud rate and parity settings during operation. This error is generated if the microprocessor on the serial communication card reads a baud rate and parity setting that differ from the settings requested by the programmer.

REBOOT FAILED
This error is reported if the serial communications card fails to generate a hardware interrupt when it is reset by the Recorder CPU.

REBOOT FAILED – COMM IS BUSY
This error is reported if the Recorder fails to complete the serial communications message it was processing when the SAVE key was pressed.

If any of these errors is encountered, turn off power to the Recorder and verify that the communications card is properly seated in the back plane connector. Turn the power back on and attempt the SAVE again.

In order to program the second serial port (dual port cards only, 078555, Catalog Suffix A = 42) press **PAGE DOWN**. The display will show:

When the desired selections have been made, press **SAVE**.

A configuration summary of the communications port programming can be obtained by selecting the SETTINGS summary on the Configuration Summary menu. Proceed as follows:

1. Press any key on the programmer's keyboard to enter Recorder Control Mode.

2. Cursor to highlight PROG MODE and press **ENTER**.

3. Key in the security code and press **ENTER**.

4. Cursor to highlight PROG and press **ENTER**.

5. Cursor to highlight SUMMARIES and press **ENTER**.

6. Cursor to highlight SETTINGS and press **ENTER**.

7. The printed summary will include OPTIONS SUMMARY, PRINT SETTINGS SUMMARY, CHART SETTINGS SUMMARY and SERIAL COMM PORT SUMMARY.

SECTION 8
MAINTENANCE

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ROUTINE MAINTENANCE

CHANGING CHART PAPER

To load chart paper, power must be ON, to enable chart feed. To operate the chart feed, press the **CHART** key and then the numeral **3** key. Press the **3** key to feed paper and press it again to stop.

To load chart paper, proceed as follows:

1. Pull open the front door of the Recorder (Fig. 8-1).

Figure 8-1
Open Recorder

2. Push down the latch behind the key panel (Fig. 8-2) and tip the panel forward. It is hinged across the bottom.

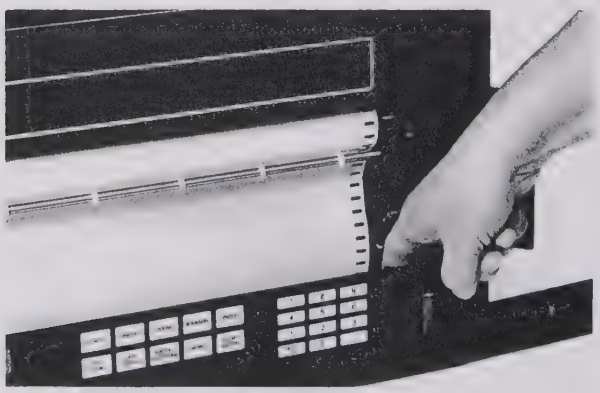


Figure 8-2
Key Panel Latch

3. Remove the guide bar by pressing it towards its spring-loaded end to free its other end (Fig. 8-3).

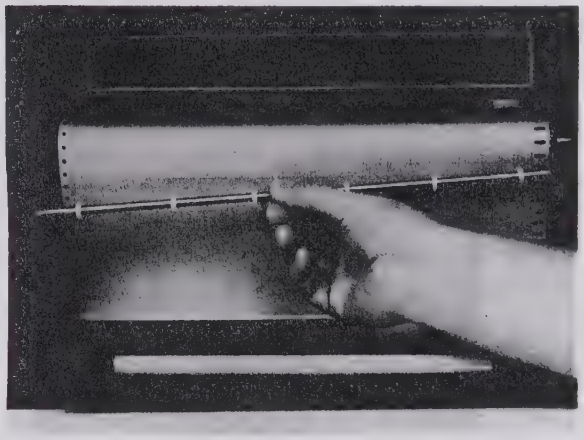


Figure 8-3
Remove Guide Bar

4. Tear the chart paper at the perforations nearest the drive roller. Remove the printed paper from the takeup tray (Fig. 8-4).

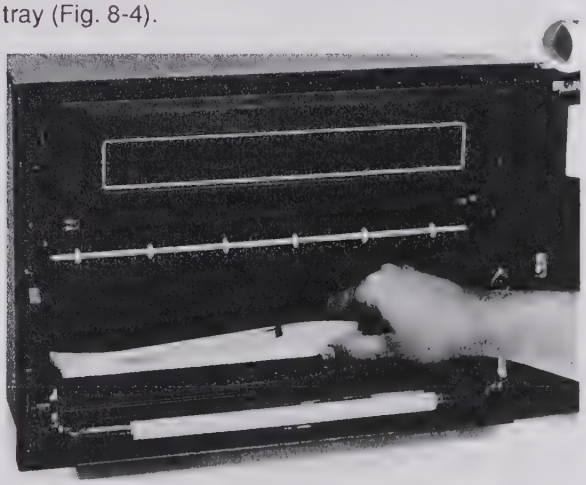


Figure 8-4
Remove Paper from Takeup Tray

8. Maintenance

5. Lift up the left and right chart drive latches (red) to lower the paper feed tray (Fig. 8-5). Remove any remaining paper from the feed tray.

Figure 8-5
Lift Chart Drive Latches

NOTE

Chart paper must be "fanned" by hand before placing it in the feed tray. Hold the paper pack on one side (do *not* hold directly on the punched holes) and "fan" the paper. Repeat, holding the other side.

6. Place a pack of paper in the tray. Drape the leading edge of the paper over the drive roller and engage the holes in the edges with the pins on the drive sprockets (Fig. 8-6). Make sure that the paper is straight and that the printed side of the paper is uppermost, as shown.

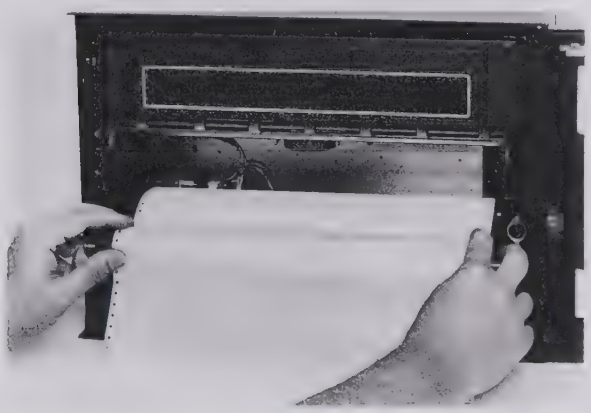


Figure 8-6
Load Paper

Note that the holes are on the left and the slotted perforations are on the right. Place an outside fold on the front side of the drive roller and replace the guide bar (Fig. 8-3).

7. Re-attach the guide bar (as shown in Step 3). Make sure the spring-loaded end is to your right.

8. Push the drive roller assembly upwards until both red latches engage (Fig. 8-7). Press downward on both red latch handles to be sure they are fully down.

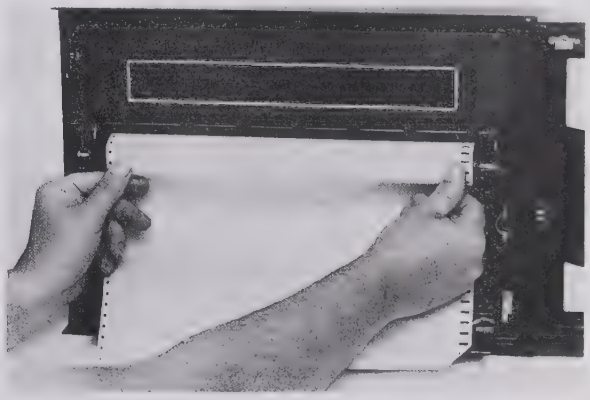


Figure 8-7
Engage Red Latches

9. Guide the paper into the takeup tray (Fig. 8-8), using the **CHART** and **3** key to feed paper through as needed.

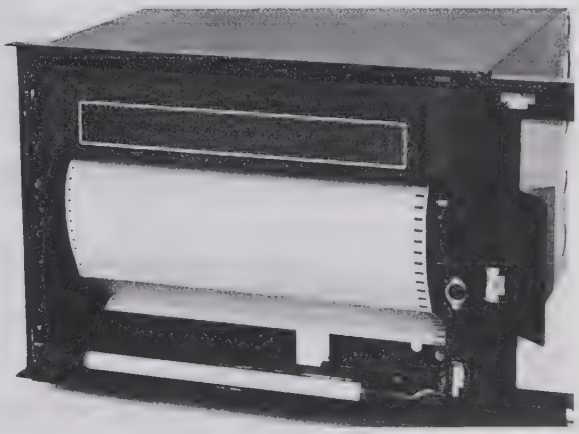


Figure 8-8
Guide Paper Into Takeup Tray

10. Lift and latch the key panel back into place. Close the Recorder door.

NOTE

After loading chart paper, printing will not resume automatically. Resume printing by selecting LO SPEED, HI SPEED or RESUME DATALOG.

8. Maintenance

CHANGING PRINTER RIBBON

The four color printer ribbon is enclosed in a disposable cartridge which must be replaced periodically. To optimize performance, replace the printhead ribbon once every 4 to 6 weeks. Proceed as follows:

1. Open the Recorder door (Fig. 8-1).

2. Lift up the left and right chart drive latches (red) to lower the paper feed tray (Fig. 8-5).

3. Loosen the two socket head screws on the Ribbon Positioning Device (RPD) (Fig. 8-9). Unscrew both approximately 1/8" to provide clearance to free the tabs from their retaining lugs. Pull the tabs toward you to free them from the lugs and turn them downward (Fig. 8-10). Pull the ribbon toward you to free it from the RPD.

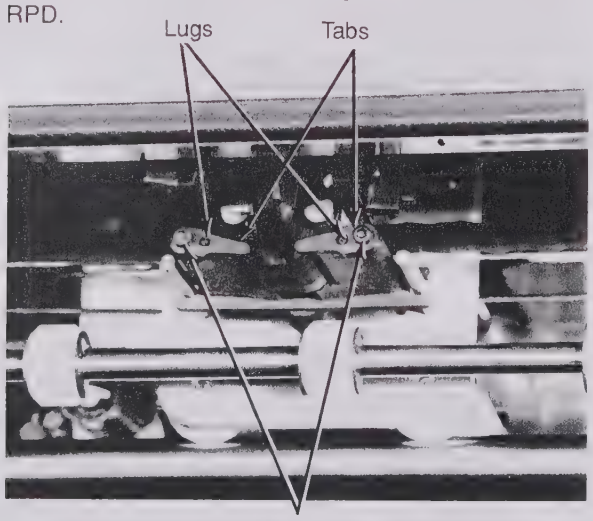


Figure 8-9
Ribbon Positioning Device in RUN Position

CAUTION

Do not attempt to close (push up and lock) the paper feed tray while the RPD tabs are down. This will gouge the drive roller and may break the tabs.

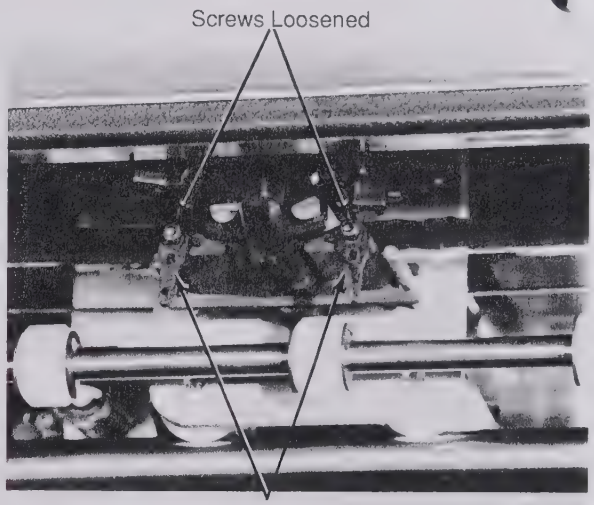


Figure 8-10
Ribbon Positioning Device Open
for Ribbon Removal and Replacement

4. Release the latch at the lower right hand corner and pivot the Recorder mainframe assembly outward (Fig. 8-11). In order to open the mainframe sufficiently to remove the cartridge, it will be necessary to lift the paper feed tray slightly to clear the latch on the left side of the case.

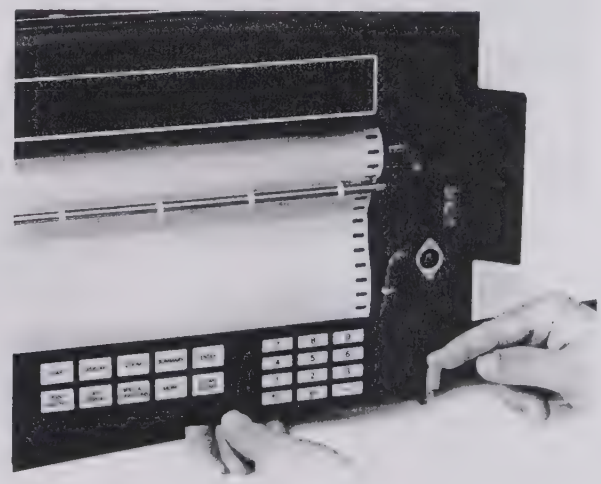


Figure 8-11
Pivot Recorder Mainframe Assembly Outward

5. Press apart the two spring levers at the ends of the cartridge to release the cartridge. Release and lift one end first, then the other (Fig. 8-12). Carefully lift the cartridge straight up and out. Note the flexible shaft and ribbon thumbwheel attached at one end (Fig. 7-13). The thumbwheel is permanently attached to the flexible shaft and engages the ribbon cartridge with a splined extension. Grasp the thumbwheel and cartridge and pull them apart to separate the cartridge from the splined shaft of the thumbwheel.

Figure 8-12
Release and Lift Spring Levers

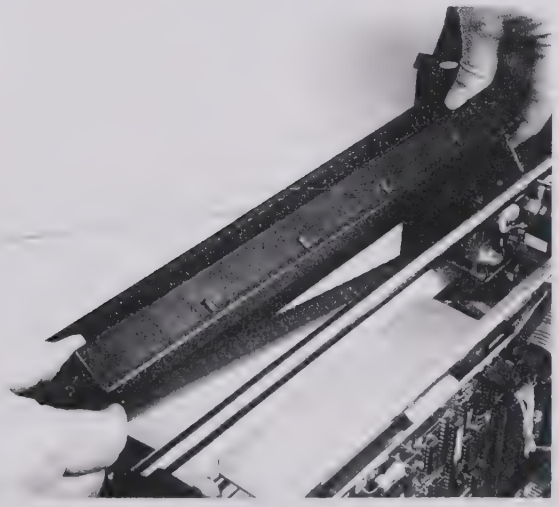


Figure 8-13
Cartridge with Thumbwheel and Flex Shaft in Place

6. To install a new cartridge, position it as shown in Figure 8-13 and insert the splined shaft of the thumbwheel into the cartridge. Insert the cartridge, position it between the spring levers (Fig. 8-12) and push down to snap it in place. Place the ribbon in the Ribbon Positioning Device (Fig. 8-10). Turn the two tabs upward, push them in to engage the lugs and tighten the screws. See Figure 8-9. Move the ribbon slightly to make sure it was not pinched when you tightened the screws. It should slide freely.

7. Turn the thumbwheel to take up any slack in the ribbon (Fig. 8-14).

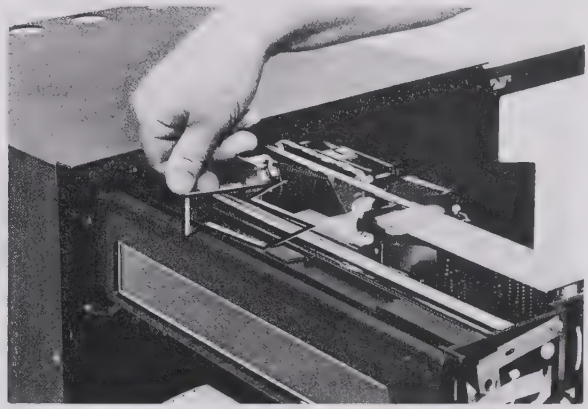


Figure 8-14
Turn Thumbwheel

8. Pivot the mainframe assembly back into position and engage the latch.

9. Push the drive roller assembly upwards until both red latches engage (Fig. 8-7). Press downward on both red latch handles to be sure they are fully down. Close the Recorder door.

8. Maintenance

SETTING THE CLOCK/CALENDAR

The SPEEDOMAX 25000 contains an internal clock/calendar from which it derives the correct time and date for printing on charts and for logging data and alarm records.

The clock/calendar is powered by a battery-backed supply and will maintain correct setting for extended periods without external power. Therefore, after initial setting it will not require attention under normal operating circumstances.

To set the time and date, proceed as follows:

1. From Run Mode, press any key on the programmer's keyboard to select Recorder Mode. The display will show:

2. With PROG highlighted, press **ENTER** to enter Program Mode. Key in the security code at the prompt and press **ENTER**. The display will show:

3. Cursor to CLOCK and press **ENTER**. The display will show:

4. With the cursor in the "DAY" column, press **ENTER** to edit. At the prompt, key in a 1 or 2 digit number (1-31) for the current day of the month and press **ENTER**.

5. Cursor to the "MONTH" column and press **ENTER** to edit. At the prompt, key in a 1 or 2 digit number (1-12) for the current month and press **ENTER**. If an entry is made outside these limits, ERR will appear.

6. Cursor to the "YEAR" column and press **ENTER** to edit. At the prompt, key in four digits for the current year and press **ENTER**.

7. Cursor to the "HOURS" column and press **ENTER** to edit. At the prompt, key in a 1 or 2 digit number (0-24) for the current hour and press **ENTER**.

8. Cursor to the "MINUTES" column and press **ENTER** to edit. At the prompt, key in a 2 digit number (01-59) for the current minute and press **ENTER**.

9. Press the **SAVE** key to save the entries in SPEEDOMAX 25000 memory. Press **ESC** to restore the previous displays and exit Clock Mode.

If an incorrect entry has been made, the message VALUE OUTSIDE OF LIMITS will appear and the item will be highlighted on the display, ready for correction.

8. Maintenance

CLEANING

Occasional cleaning is required, the frequency of which depends upon the environment. All moving parts, such as pulleys, gears and carriage shafts should be kept as clean as possible.

If necessary, remove traces of pigment from the chart drive roller with a solution of detergent and water. Do not use solvents.

To clean the window, use a soft cloth moistened with water and a mild detergent. Do not use solvent or abrasive type cleaners.

Do not attempt to disassemble any part of the Recorder for cleaning. If problems are encountered, consult service personnel.

LUBRICATION

Lubricate the lead screw on the stepper motor which controls the ribbon color shift on the printhead carriage.

Use Amsoil Multipurpose Synthetic Grease. This should be done annually.

SERVICE

For repair, replacement or adjustments which are not covered by this manual, refer to Service Manual No. 277801 or consult your L&N representative.

8. Maintenance

CALIBRATION

GENERAL

Calibration of the SPEEDOMAX 25000 is a simplified automated procedure, performed by using the programmer's keyboard and the front panel display as described in this section.

IMPORTANT

A proper ground strap must be used whenever contact will be made with any electronic assemblies or components (L&N Part Number 035968).

This section includes instructions for making calibration connections to circuit cards which require calibration in the Recorder and also in the optional Expansion Unit, and procedures for calibrating each type of card. There is also a procedure for calibrating the chart. SPEEDOMAX 25000 items which require calibration are as follows:

Analog Input Cards:

074417 - 15 Point High/Low Level TC/EMF
074415 - 10 Point High/Low Level TC/EMF
074425 - 8 Point High Level EMF
228255 - 10 Point RTD

Analog Output Card:

074471 - Analog Retransmission Output Card with one to four 074411 Dual VAT (Voltage Adjusting Type) daughter cards

Chart:

Zero Reference Position

Access to Circuit Cards - Recorder

1. Open the Recorder door (Fig. 8-1), unlatch and swing open the main frame assembly (Fig. 8-11).

2. Loosen four screws and lift the rear panel to remove it (Fig. 8-15).

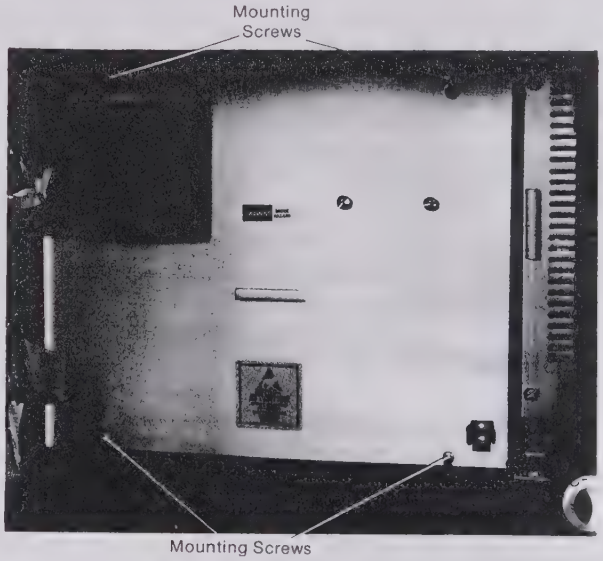


Figure 8-15
Lift Rear Panel

3. The four card slots are numbered 1-4 from bottom to top (Fig. 8-16). Calibration cable connectors are located at the left front corners (Fig. 8-17).

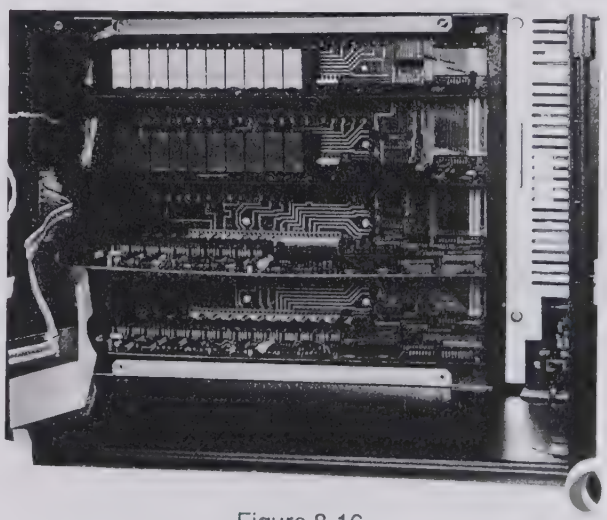


Figure 8-16
Four Card Slots

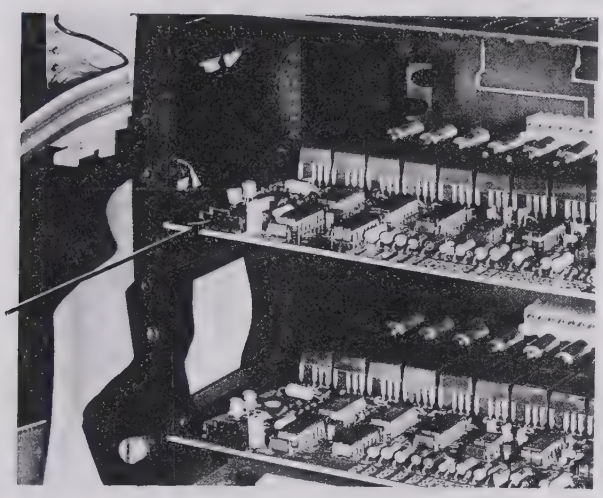


Figure 8-17
Calibration Cable Connectors

4. To prepare for calibration, remove the circuit card and install the SPEEDOMAX 25000 card extender (L&N Part Number 078661) (not included with Recorder). Remove and replace the card as shown in Fig. 8-18. This extender is required for all analog input cards, when calibrating.

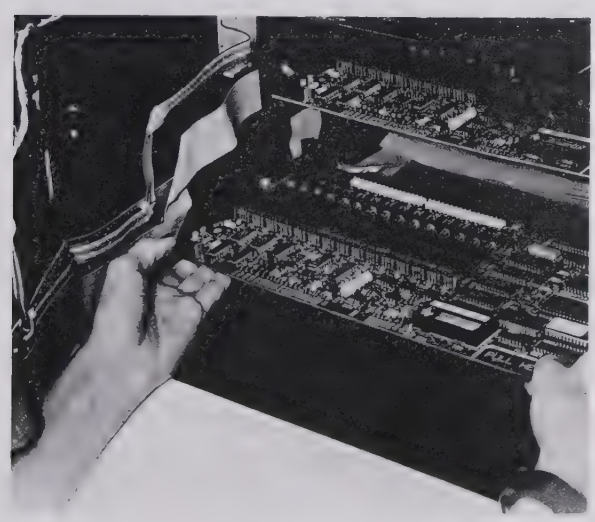


Figure 8-18
Remove Circuit Card

NOTE

If the card extender is not used, then the rear terminal board must be disconnected from the analog input board as follows:

- *Remove the rear cover by loosening the two captive binding head screws on the left and right sides at the center.*
- *Tag, then remove the leads connected to the terminal board.*
- *Remove the two 6-32 x 5/16 binding head screws, one at each end of the grounding strip.*
- *Remove the two hex spacers, washers and lock washers at the ends of the terminal board assembly. Do not try to remove the threaded studs; they are part of the Recorder case.*
- *Remove the terminal board interface.*

NOTE

Provide anti-static protection when handling circuit cards. Grasp cards only as shown in Fig. 8-18 and apply force evenly to both sides when removing or replacing. Two hands must be used.

Any electronic components or assemblies must be stored in anti-static bags once removed from their mounted position in the Recorder.

8. Maintenance

Access to Circuit Cards – Expansion Unit

For access to circuit cards, remove the front cover, swing out the card cage, then remove the card cage cover and access panel as follows:

1. Refer to Fig. 8-19. The four screws that hold the front cover on the case are captive in the cover. Use a screwdriver to loosen these screws.

Figure 8-19
Front Cover Screws

CAUTION
The cover is heavy. **While holding it in place with one hand, unscrew the screws until they are free of the case, then remove the cover and lay it aside.**

2. Refer to Fig. 8-20. Release the latch and swing the card cage out.

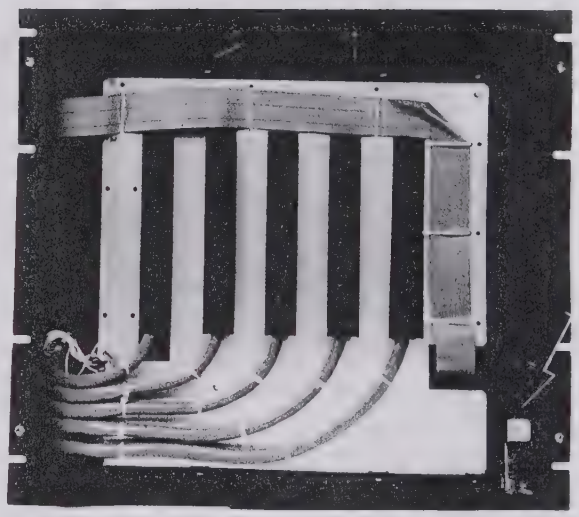


Figure 8-20
Expansion Unit with Front Cover Removed.

3. Refer to Fig. 8-21. Loosen the four screws that hold the card cage cover in place. Remove and lay the cover aside.

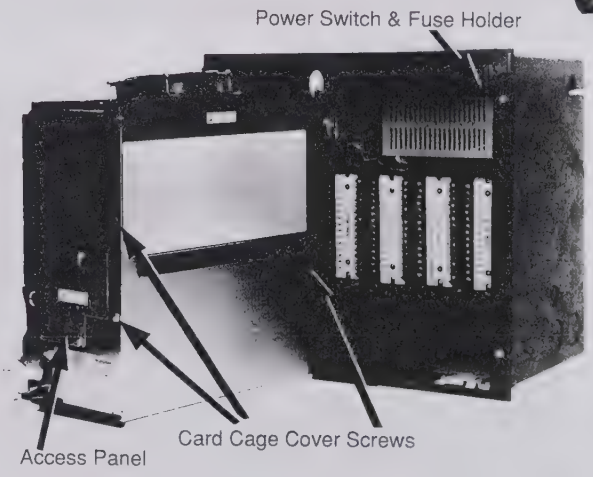


Figure 8-21
Card Cage Swung Out

4. Refer to Fig. 8-21. Loosen the two screws that hold the access panel in place. Remove the panel and lay it aside.

5. Disconnect the signal input connector on the opposite side of the card cage cover (see Figure 8-20) for each analog card to be calibrated.

8. Maintenance

CALIBRATION PROCEDURE

Calibration requires use of the programmer's keyboard and front panel display. Refer to Section 6, Programming, for complete instructions on the use of these items. Security code entry is also required. This is also explained in Section 6.

Following procedures in Section 6, connect the programmer's keyboard and access the top level programming display:

Cursor to CALIB and press **ENTER** to edit. The display will show:

The top line lists the choices for calibration: CHART, SLOT 1, SLOT 2, SLOT 3, or SLOT 4. The type of card installed in each slot is designated directly below the slot number. If an optional Expansion Unit is installed, the message MORE will be present. If you cursor to MORE and press **ENTER**, the display will show:

Expansion Units contain 5 card slots, numbered 5 through 9, as shown. Cursor to MORE and press **ENTER** to restore the previous display.

These displays are used for access to circuit cards in each slot for calibration purposes. As you cursor from one slot to another on this display, note that the cursor will not highlight a slot containing a type of card which does not require calibration (slots 5, 7, 8 and 9 in the above example).

The procedure for calibration consists of highlighting the desired slot, pressing **ENTER** and then responding to step-by-step prompt messages to perform the calibration. When the procedure is complete for the particular slot, press **ESC** to restore the slot access display and cursor to the next slot to be calibrated.

The following individual calibration procedures for each type of I/O card assume keyboard entries will begin at the point where access to the slot has been obtained, using the foregoing procedure.

8. Maintenance

Analog Input Card Calibration

074415 - 10 Point & 074417 - 15 Point low Level TC/ EMF Card Calibration

The first display for a slot containing a 10 point analog input card will be:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         10 MILLIVOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 0.0 MV AND PRESS [ENTER] TO CALIBRATE
```

Calibrate as follows:

1. Connect cable 074484 to the calibration connector on the card being calibrated (Figs. 8-17 and 8-22). If cable 074484 is not used, connect a two lead cable to pins 1 (+) and 3 (-) of the connector per Fig. 8-23.

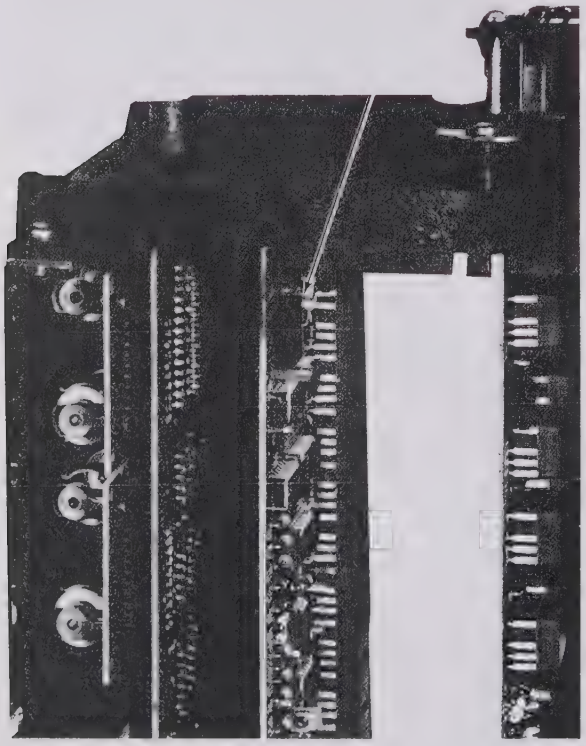


Figure 8-22
Expansion Unit - Rear View - Cover Removed

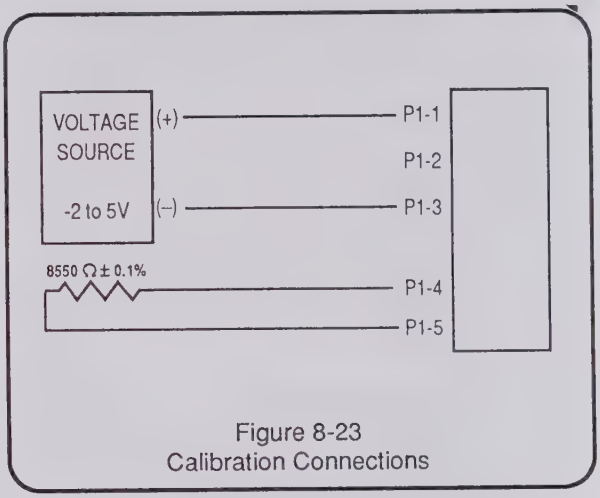


Figure 8-23
Calibration Connections

2. Connect the other end of the cable to a calibrated voltage source capable of a span from 10 mV to 10 V, accurate to + or - 0.01%.

Connect the red lead to + and the black lead to -. If cable 074484 is not used, connect the cable used per Fig. 8-23.

NOTE

If the value measured for the calibrated input is not within reasonable calibration limits , an error message will be displayed. This may be caused by:

- *The calibration cable is disconnected.*
- *The calibration cable is reversed at the voltage source.*
- *A span value was applied when 0.0 V was requested.*
- *0.0 V was applied when a span value was requested.*

3. As requested by the display prompt, set the voltage source to 0.0 V and press **ENTER** to calibrate. The display will show:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         10 MILLIVOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 0.0 MV          ** CALIBRATING - WAIT **
```

After a delay of approximately 5 seconds, calibration will be complete and the display will show the next input to calibrate:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         10 MILLIVOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 10.0 MV AND PRESS [ENTER] TO CALIBRATE
```

4. As requested by the prompt, set the voltage source to 10.0 mV and press **ENTER** to calibrate. The display will show the message CALIBRATING – WAIT for approximately 5 seconds, followed by this display:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         25 MILLIVOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 0.0 MV AND PRESS [ENTER] TO CALIBRATE
```

This is the display for the next input on the card. Repeat the previous steps for the rest of the inputs, which will be displayed in this sequence: 0.0 V, 10 mV, 0.0 V, 25 mV, 0.0 V, 50 mV, 0.0 V, 0.10 V, 0.0 V, 0.25 V, 0.0 V, 0.50 V, 0.0 V, 1.0 V, 0.0 V, 2.5 V, 0.0 V, 5.0 V. Note that zero volts is recalibrated before each voltage level in the calibration process.

To move to a particular point in this sequence, use the ^ key to move forward. The **ESC** key will return the previously used card slot access display (either this one, or the slot 5-9 display):

```
MORE CHART SLOT 1  SLOT 2  SLOT 3  SLOT 4
           10-PT   8-PT    RTD     15-PT
← → ENTER ESCAPE
CALIBRATE CHART
```

5. When the last voltage input (5.0 Volt) has been calibrated, the display will show:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         INTERNAL ZERO CALIBRATION
↑ ENTER ESCAPE
PRESS [ENTER] TO CALIBRATE INTERNAL ZERO
```

Press ENTER. The display will show the message CALIBRATING – WAIT for approximately 5 seconds, after which the display will show the final item for the calibrating of this card:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         REF JUNCTION CALIBRATION
↑ ENTER ESCAPE
PRESS [ENTER] TO CALIBRATE REFERENCE JUNCTION
```

6. If cable 074484 is not used, install an 8550 ohm (+ or - 0.1%) resistor across pins 4 and 5 of the calibration connector on the card being calibrated per Fig. 8-23.

Press **ENTER** to calibrate the reference junction. When complete, the first display of the whole series will appear:

```
SLOT 1   10 POINT ANALOG INPUT CARD
         10 MILLIVOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 0.0 MV AND PRESS [ENTER] TO CALIBRATE
```

Calibration of the card is complete. Press **ESC** to return to the card slot access display:

```
MORE CHART SLOT 1  SLOT 2  SLOT 3  SLOT 4
           10-PT   8-PT    RTD     15-PT
← → ENTER ESCAPE
CALIBRATE CHART
```

7. Remove cable 074484 from the calibration connector on the card. If cable 074484 was not used, remove the cable used and the 8550 ohm resistor.

The foregoing procedure illustrates calibration of the 10 point card. The procedure for a 15 point card is the same.

074425—8 Point High Level EMF Card Calibration

The first display for a slot containing an 8 point high level analog input card will be:

```
SLOT 1    8 POINT ANALOG INPUT CARD
          10 VOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 0.0 VOLT AND PRESS [ENTER] TO CALIBRATE
```

Calibrate as follows:

1. Connect cable 074484 (not included with the Recorder) to the calibration connector on the card being calibrated (Figs. 8-17 and 8-22). If cable 074484 is not used, connect a two lead cable to pins 1 (+) and 3 (-) of the connector per Fig. 8-24.

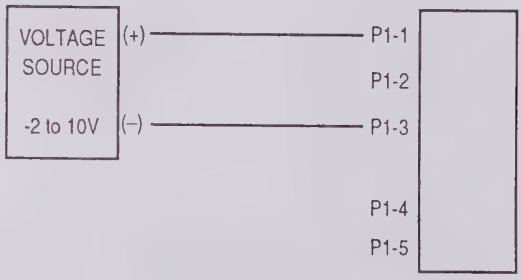


Figure 8-24
Calibration Connection
074425—8 Point High Level EMF Cards

2. Connect the other end of the cable to a calibrated voltage source of 10 V, accurate to + or -0.01%. Connect the red lead to + and the black lead to –. If cable 074484 is not used, connect the cable used per Fig. 8-24.

NOTE

If the value measured for the calibrated input is not within reasonable calibration limits, an error message will be displayed. This may be caused by:

- *The calibration cable is disconnected.*
- *The calibration cable is reversed at the voltage source.*
- *A span value was applied when 0.0 V was requested.*
- *0.0 V was applied when a span value was requested.*

3. As indicated by the display prompt, press **ENTER** to calibrate. The display will show the message CALIBRATING —WAIT for approximately 5 seconds, followed by this display:

```
SLOT 1    8 POINT ANALOG INPUT CARD
          10 VOLT GAIN SETTING
↑ ENTER ESCAPE
SET CALIB SOURCE TO 10.0 VOLT AND PRESS [ENTER] TO CALIBRATE
```

4. Set the voltage source to a value of 10.0 Volt a press **ENTER** to calibrate. The display will show message. CALIBRATING—WAIT for approximately 5 seconds, followed by this display:

```
SLOT 1    8 POINT ANALOG INPUT CARD
          INTERNAL ZERO CALIBRATION
↑ ENTER ESCAPE
PRESS [ENTER] TO CALIBRATE INTERNAL ZERO
```

5. As the prompt indicates, press **ENTER** to calibrate the internal zero. The display will show the message CALIBRATING—WAIT for approximately 5 seconds, after which the first display of the series will reappear (0.0 volt calibration). This completes the calibration of the 8 point Analog Input Card. Press **ESC** to return to the slot selection display.

6. Remove cable 074484 from the calibration connector on the card.

228255—10 Input RTD Card Calibration

The first display for a slot containing a 10 point RTD input card will be:

```
SLOT 1    RTD ANALOG INPUT CARD
          10 OHM COPPER GAIN SETTING  - NO LEAD RESISTORS
↑ ENTER  ESCAPE
SET RES SOURCE TO 7.113 OHM  AND PRESS  [ENTER]  TO CALIBRATE
```

Calibrate as follows:

1. Connect cable 074485 (not included with the Recorder) to the calibration connector on the card being calibrated (Figs. 8-17 and 8-22). If cable 074485 is not used, connect a five lead cable per Fig. 8-25.

2. Connect the other end of the cable to a calibrated resistance source. If cable 074485 is not used, connect the cable per Fig. 8-25.

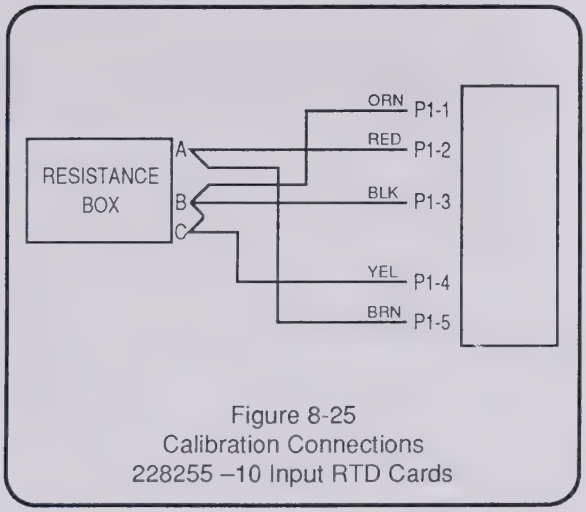


Figure 8-25
Calibration Connections
228255 –10 Input RTD Cards

TABLE 8-1
Resistance Source Settings
for Display Indication

Display Indication	Resistance Source Setting
10 ohm Copper Gain Setting	7.113
10 ohm Copper Gain Setting	14.820
100 ohm Platinum Gain Setting	27.01
100 ohm Platinum Gain Setting	389.94
1000 ohm Platinum Gain Setting	266.0
1000 ohm Platinum Gain Setting	2875.0

NOTE

If the value measured for the calibrated input is not within reasonable calibration limits, an error message will be displayed. This may be caused by:

- *The calibration cable is disconnected.*
- *The wrong resistance source setting was applied to the input.*
- *The input card may be faulty.*

3. As indicated by the display prompt, set the resistance source to 7.113 ohms and press **ENTER** to calibrate.

The display will show the message CALIB-RATING-WAIT for approximately 5 seconds, followed by the next display:

```
SLOT 1    RTD ANALOG INPUT CARD
          10 OHM COPPER GAIN SETTING  - NO LEAD RESISTORS
↑ ENTER  ESCAPE
SET RES SOURCE TO 14.820 OHM  AND PRESS  [ENTER]  TO CALIBRATE
```

4. As indicated by the display prompt, set the resistance source to 14.280 ohms and press **ENTER** to calibrate. Repeat this procedure for the next four selections which appear, completing calibration of the resistances listed in Table 8-1. When the last has been calibrated, the display will show:

```
SLOT 1    RTD ANALOG INPUT CARD
          10 OHM COPPER GAIN SETTING  - 5 OHM LEAD RESISTORS
↑ ENTER  ESCAPE
SET RES SOURCE TO 7.113 OHM  AND PRESS  [ENTER]  TO CALIBRATE
```

This is the first of three additional calibration steps for this card. Refer to Table 8-2 for the resistance settings to be used in the following steps.

5. Connect equal value resistors (5 ohms, + or - 0.1%) in series with the A and B leads of the cable at the resistance source per Fig. 8-26.

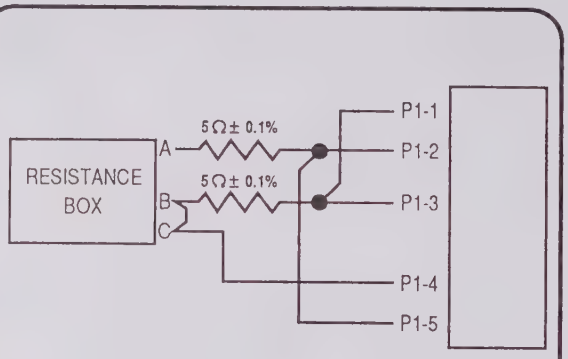


Figure 8-26
Calibration Connections
228255 – 10 Input RTD Cards.

NOTE

The leads on both resistors must be of equal length.

NOTE

If an error message occurs during the following steps, check the following:

- *Verify that the value of the resistors connected in series with the A and B leads is 5 ohms + or - 0.1%.*
- *Verify that the proper resistance source setting was used per Table 8-2.*
- *Verify that the calibration cable is properly connected.*
- *The input card may be faulty.*

6. As indicated by the prompt, set the resistance source to 7.113 ohms and press **ENTER** to calibrate.

Table 8-2
Resistance Source Settings
fc Display Indications

Display Indication	*Resistance Source Setting*
10 ohm copper gain setting - 5 ohm lead resistors	7.113
100 ohm platinum gain setting - 5 ohm lead resistors	27.01
1000 ohm platinum gain setting - 5 ohm lead resistors	266.0

The display will show the message CALIBRATING - WAIT for approximately 5 seconds, followed by the next display. Repeat this procedure for all the resistance source settings in Table 8-2. When the last is complete, the display will show:

7. As indicated by the prompt, press **ENTER** to calibrate the internal zero. The display will show the message CALIBRATING - WAIT for approximately 5 seconds, after which the first display of the calibration series will appear. This completes calibration of the RTD card. Press **ESC** to restore the slot selection display.

8. Maintenance

074471 - Analog Retransmission Output with One to Four 074411 Dual VAT Daughter Cards (Two Outputs per Daughter Card)

In order to calibrate an analog output, it is necessary to know the span of the output.

Each Analog Retransmission Output card contains eight analog retransmission output positions designated as AO1 through AO8 for slot 1 and AO16 through AO 23 for slot 2.

The maximum span for voltage retransmission outputs is 0-5V or 0–10V. When calibrating analog outputs for voltage retransmission, check to see that switches S1 and S2 on the circuit card are set for the proper output span. S1 has 6 positions and sets the span for the output in Position A. S2 has 8 positions and sets the span for the output in Position B.

Table 8-3 indicates the switch position settings for voltage retransmission outputs.

TABLE 8-3

Output	Switch S1 or S2 Position Settings						S2 Only	
	1	2	3	4	5	6	7	8
0-5V	ON	ON	OFF	OFF	OFF	ON	OFF	ON
0-10V	OFF	ON	OFF	OFF	OFF	ON	OFF	ON

1. Refer to the label on the card cage cover. Locate the terminals being used for the position selected for calibration and connect a DC voltmeter capable of 0.025% resolution.

2. The first display for calibration of an AO card is:

```
AO1   AO2   AO3   AO4   AO5   AO6   AO7   AO8
VAT   VAT   NONE  NONE  VAT   VAT   NONE  NONE
<- -> ENTER ESCAPE
CALIBRATE AO1
```

Assuming the voltmeter is connected to the terminals for AO1, highlight AO1 and press **ENTER** to edit. The display will show:

```
AO1
      ZERO SPAN
<- -> ENTER ESCAPE
CALIBRATE ZERO
```

3. With ZERO highlighted, press **ENTER**. The display will show:

```
AO1      CALIBRATE ZERO

PRESS ↑ AND ↓ UNTIL MEASURED OUTPUT IS AT DESIRED ZERO VALUE
THEN PRESS [ENTER] TO CALIBRATE
```

As the prompt indicates, press the up and down cursor keys to adjust the meter reading to the desired zero value and then press **ENTER** to calibrate. The display will show the message CALIBRATING - WAIT for approximately 5 seconds, after which the Zero-Span display will return:

```
AO1
      ZERO SPAN
<- -> ENTER ESCAPE
CALIBRATE ZERO
```

4. Cursor to SPAN and press **ENTER**. Following the same procedure as for Zero, follow prompts to set the output for the desired span value. This completes calibration of AO1. The display will return to the first display of the series. Connect the meter to the proper terminals for the next position to be calibrated and repeat the foregoing procedures. When all positions are calibrated, press **ESC** to restore the slot selection display.

CHART LEFT MARGIN CALIBRATION

1. On the first level calibration display (slot selection display) cursor to CHART and press **ENTER.**

2. As the prompt indicates, use the left and right cursor keys to position the printhead to the desired zero position and press **ENTER** to mark the paper. If the mark is not on the zero line, press left or right cursor keys and press **ENTER** again until the mark prints on the zero line. Press **ESCAPE** to exit calibration mode. Chart calibration is automatically saved. (It is not necessary to press the SAVE key.)

NOTE

If the message ERROR: CHART CALIBRATION OUT OF RANGE appears, consult Service Manual #277801.

RPD CALIBRATION

NOTE

This feature must be used with PROMs of Issue D or later.

RPD calibration allows the user to calibrate the "home" position of the RPD (Ribbon Positioning Device – ribbon guide). If the characters are not printing in the correct colors, or do not appear to be printing correctly, such as in two colors, calibrate the RPD. The RPD Calibration Display can be found under the CALIB display menu. The calibration procedure is as follows:

1. Press any key on the programmer's keyboard to enter Recorder Control Mode.

2. Cursor to highlight PROG MODE and press **ENTER**.

3. Key in the security code and press **ENTER**.

4. Cursor to highlight CALIB and press **ENTER**.

5. Cursor to highlight MORE and press **ENTER** twice.

6. Cursor to RPD and press **ENTER**. The RPD Calibration display will appear. The upper right corner of the display contains the current calibration value of the RPD. This value will normally be in the range of 1 through 20.

7. Press **ENTER** to print the sawtooth test pattern.

8. Examine the color of the sawtooth test pattern; a properly calibrated unit will have a green sawtooth with a red dot at the apex.

9. Use the up and down cursor arrows to adjust the position of the RPD as reflected by the value in the upper right corner of the display.

10. Repeat steps 7, 8 and 9 until the sawtooth test pattern has the correct coloration and arrangement.

11. Press **ESCAPE** to save the calibration value to the data base.

9. Parts

To obtain spare parts for this product, please contact your local Leeds & Northrup field sales or service office. When ordering parts or accessories, please supply the following information:

1. Recorder Model Number
2. Part Description
3. Part Number

REPLACEMENT PARTS

For a complete listing of replacement parts for this product, refer to Service Manual No. 277801.

CALIBRATION

To calibrate the Recorder, the following must be purchased:

- All — Extension Card 078661 $64.00
- T/C or EMF — Calibration Cable - EMF 074484 - 20.00
- RTD — Calibration Cable - RTD 074485 - 9.00

ACCESSORIES

Battery (Tadiron High Energy Lithium Battery TL-5101)	074466
Chart Paper	677001
Label	078724
Line Cord (120V, 60 Hz only)	337050
Mounting Kit	078730
Program Storage Unit (See Section 1)	078725
Rack Mount Plate, 19"	078769
Resistor, Current Shunt (250 Ohms)	074477
Ribbon Cartridge	078913
Software Update Kit, Domestic	078672
Software Update Kit, Multi-language	078677
Table Top Stand Kit	078770

EXPANSION COMPONENTS

Input/Output Cards – Recorder accommodates up to 4 input/output cards, Expansion Unit accommodates up to 5 I/O cards. See Manual No. 277807 for parts required.

RECOMMENDED SPARE PARTS LIST

Description	Part No.	Number of Recorders			
		1-3	4-10	11-20	Over 20
Analog 8 Pt PC Assembly	074425*	0	1	1	2
Analog 10 Pt PC Assembly	074415*	0	1	1	2
Analog 15 Pt PC Assembly	074417*	0	1	1	2
Analog 15 Pt PC Assembly – High Noise Immunity	074495*	0	1	1	2
Analog PC Assembly (2, 4, 6 or 8 Pt)	074471*	0	1	1	2
Analog 10 Pt RTD Assembly	228255***	0	1	1	2
Analog VAT PC Assembly	074411*	0	1	1	2
Backplane Assembly	078553	0	1	1	2
Ballast, 120V, 50/60 Hz	020524	0	1	1	2
Ballast, 220V, 50/60 Hz	078666	0	1	1	2
Ballast, 240V, 50/60 Hz	078665	0	1	1	2
Chart Drive Belt	078900	1	2	3	4
CPU PC Assembly	078683	0	1	1	2
DI PC Assembly, 7 Pt, DO, 8 Pt	074463*	0	1	1	2
Discrete Input PC Assembly, 15 Pt	074429*	0	1	1	2
Discrete Output Assembly, 10 Pt	074431*	0	1	1	2

* *Required for particular configurations.*

** *Must order set.*

*** *Replaces 074437 in Recorders shipped after April, 1991. 228255 requires Software Rev. F or later to be ordered as a separate item if required. Applications using 10 ohm copper (Recorder Suffix 13) require 228255 which provides improved noise immunity; other RTDs may use 228255 (with appropriate Software Rev. level) or 074437.*

9. Parts

RECOMMENDED SPARE PARTS LIST (con't)

Description	Part No.	Number of Recorders			
		1-3	4-10	11-20	Over 20
Display - Plasma Assembly	078566**	0	1	1	2
Display Card Filter	078918**	0	1	1	2
Drive Cord	078846	1	2	3	4
Dual Port Communications Assembly	078555	1	1	2	2
Expansion Unit Backplane Assy	074427	0	1	1	2
Expansion Unit Power Supply Kit	074513	0	1	1	2
External Cable, 26 Position	074453	0	1	1	2
Fan	078663	0	1	1	2
Fuse	014107	1	2	3	4
Glass Door	078801	0	1	1	2
Keyboard - Hand-held	078593*	0	0	1	1
Keyboard - Computer (IBM Format)	078755*	0	0	1	1
Lamp, Fluorescent	026022	1	1	2	2
Operational Keyboard	080160	0	1	1	2
Operational Keyboard, Multi-language	080161	0	1	1	2
Optocoupler	093120	0	1	1	2
Paper End Sensor Cable	078598	0	1	1	2
Power Supply PC Assembly	078581	0	1	1	2
Printhead Module Assembly	078588	1	1	2	2
Printhead	078838	1	1	2	2
Cable Flat Flex	078571	1	1	2	2
Pulley Assembly	078863	1	1	2	2
Ribbon Guide (RPD)	078763	1	1	2	2
Stepper Motor - Chart Drive	017982	0	1	1	2
Stepper Motor - Printhead	017983	1	1	1	2
Stepper Motor - Ribbon Positioning	078659	1	1	2	2
Pulleys - Detour	078901	1	2	3	4
Pulse Input PC Assembly	074445*	0	1	1	2
Relay Output PC Assembly	074435*	0	1	1	2
Single Port Communications Assembly	078669	1	1	2	2
Solid State Relay	036807*	1	2	3	4
Solid State Relay	036808*	1	2	3	4
Solid State Relay	036809*	1	2	3	4
Solid State Relay	036810*	1	2	3	4
Solid State Relay	036811*	1	2	3	4
Solid State Relay	036812*	1	2	3	4
Starter, 120V	501104	1	1	2	2
Starter, 220/240V	078667	1	1	2	2
Stepper Motor Assy - Ribbon Advance	078662	1	1	2	2
TB Assembly, 2-wire	078559	1	1	2	2
TB Assembly, 3-wire	078561	1	1	2	2
Thermal Sensor	074566	0	1	1	2

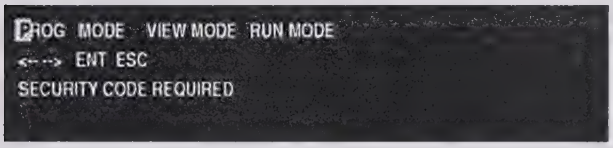
* *Required for particular configurations.*

** *Must order set.*

APPENDIX A
SECURITY BYPASS FEATURE

For effective use of security features, it is recommended that security codes be memorized and any written code records be retained in a safe place, such as a secure file in the company office responsible for security. In the event that codes are lost and no records are available, use the following procedure:

1. Enter the Recorder Control Mode as described previously, by accessing this display:



2. Cursor to VIEW and press **ENTER**.

3. Cursor to SECURITY and press keys in this sequence:

ENTER
R
SQUARE ROOT
COPY

Pressing **COPY** will bring up the Password Maintenance display, which will show both security codes.

CAUTION
To protect the security system, remove this page from this document and file it in a secure location.

Appendix

APPENDIX B
ERROR MESSAGES

This section lists error messages which may appear on the display during operation or programming of the Recorder. The messages are listed in three categories:

1. Errors occurring while using the operator's keyboard.

2. Errors occurring during programming of the Recorder.

3. Internal diagnostic errors.

If an error message appears on the display, look it up on the following lists and take the recommended action.

OPERATOR KEYBOARD ERROR MESSAGES

The following errors may occur when using the Operator's Keyboard.

BAD ZONE COMBINATION - CHART OFF
The current list of group(s) to be trended calls for an invalid zone combination. For example, Group 1 format of 1/2 Left and Group 2 format of Full. Also note that the chart has been turned "OFF".

Response: Change one or more of the scale formats for the groups. The final group list must not be in conflict. Good combination - Group 2 format 1/2 Left with Group 3 format 1/2 Right.

CAN'T TREND DISCRETES - CHART OFF
Within the current list of group(s) to be trended, one or more discrete groups are specified.

Response: Enter trend group list having only analog groups.

CHART PT HLD INVALID - CHART OFF
Due to programming changes to the point being held going into program mode, this point is not now an active point. POINT HOLD has been released on the chart. Also note that the chart has been turned "OFF".

Response: Select POINT HOLD for an active point.

END OF DATA
The operator has reviewed all data for the selected function. Press the **ENTER** key to continue.

MORE THAN 30 POINT TREND – CHART OFF
Within the current list of group(s) to be trended, there are more than 30 points TOTAL which are specified to trend at the same time. Also note that the chart has been turned "OFF".

Response: Decrease the total number of points in the group(s) listed. This may be done by either removing one or more points from the group(s) or removing one or more of the groups. Note that a "skipped" point is not included in the count of 30 points.

NO ACTIVE POINTS
The group requested for display does not contain any active points; that is, points which have been programmed either by the user or by default (due to the presence of AI, DI, or DO hardware). Please note that Analog Outputs (AOs) are not considered active until they have been fully programmed by the user.

NO DATA AVAILABLE
There is no data for the function selected by the operator. For example, the operator has selected the FORCE feature using **SPECIAL FUNCTIONS** key when there are no DO or DI points in the Recorder.

NO TRENDABLE POINTS – CHART OFF
Within the current list of group(s) to be trended there are one or more zones for which no points can be trended. This means that there is not at least one of the following (per zone) - an active Analog Input, Analog Output or Pseudo Point with an analog output. Also note that the chart has been turned "OFF".

Response: Correct either the group number(s) in the list or change one or more of the points in the group to active points. Note that having only "skipped" points in a group results in a non-trendable group.

REQUESTED POINT NOT AVAILABLE
The point selected by the operator is not available to be used with the selected function because either the point has not been programmed, or there is no hardware present to support the selected point.

REQUEST QUEUE IS FULL
The request queue for the **SUMMARY** key has 10 pending unprocessed entries. The operator should verify that the chart is ON (using the **CHART** key).

SELECTED POINT DOES NOT MATCH ZOOM POINT
The operator is attempting to change the currently active ZOOM scale, but has selected a point which has different characteristics than the currently active ZOOM point.

SELECTION NOT ALLOWED – POINT HOLD IS ACTIVE
The selection made by the operator cannot be processed because it would cancel the current Point Hold set-up for either the display or chart. Point Hold must be deliberately cancelled using the **POINT HOLD/RELEASE** key.

ZOOM IS NOT ACTIVE
The operator is attempting to display the list of Zoomed points when the Zoom feature itself is not active.

ZOOM POINT MUST BE AI, AO, or PP
Only active Analog Input, Analog Output, or Pseudo Points may be selected for Zoom.

Appendix

PROGRAMMING ERROR MESSAGES

The following errors may be encountered during the programming of the Recorder. Most of the errors will occur as a result of pressing the **SAVE** key. In addition to displaying the error message, the field which caused the error will be "highlighted" in reverse video. An explanation and recommended response is listed for each error.

AI CARD IS INCOMPATIBLE WITH INPUT TYPE
Analog Input programming. The Input Type selected for this point is not compatible with the type of input card. For example, Input Type "Type J" cannot be assigned to a point on an RTD card.

Response: If the wrong point has been selected, reselect the correct point to be programmed. Otherwise, select a new Input Type and re-save the point.

CHANGES WILL BE LOST UNLESS (SAVE) IS PRESSED
One or more fields of information for a point or feature has been edited, but the recorder database has not been updated.

Response: Press **SAVE** to update the Recorder database. Press **ESCAPE** to ignore any changes entered. Press **ENTER** to continue the edit process.

CIRCUIT HIGH INVALID
Analog Input programming.
DIRECT circuit input: The Right Scale value is outside the limits of the measuring circuit for the analog input card.

INDIRECT circuit input: The High Circuit value is outside the limits of the measuring circuit for the analog input card.

Response: Refer to the Ranges/Accuracy Table in Section 2 of this manual for range limits.

CIRCUIT LOW INVALID
Analog Input programming.
DIRECT circuit input: The Left Scale value is outside the limits of the measuring circuit for the analog input card.

INDIRECT circuit input: The Low Circuit value is outside the limits of the measuring circuit for the analog input card.

Response: Refer to the Ranges/Accuracy Table in Section 2 of this manual for range limits.

CIRCUIT TYPE INVALID
Analog Input programming, Indirect circuit input only. The Circuit Units specified is incorrect.

Response: Reselect the Circuit Units and re-save.

COPY OF EQUATION ARRAY FULL
Part of the internal database for the current point or feature is full.

Response: No additional points or features of the current type can be programmed unless existing ones are removed.

CYCLE TIME EXCEEDED
The number of Alarm Levels and Pseudo Points programmed in the Recorder cannot be processed within one second.

Response: No additional Alarm Levels or Pseudo Points can be programmed unless existing Alarm Levels or Pseudo Points are removed.

DATABASE CHECKSUM ERROR
The programmed data for the selected point or feature has been corrupted in the recorder database.

Response: Review the data displayed for this point or feature and correct any errors. Press **SAVE** to update and correct the Recorder database.

END OF DATA
The operator has reviewed all data for the selected function.

Response: Press the **ENTER** key to continue.

INVALID ELECTRICAL SPAN
Analog Input programming. The electrical span defined by the user is less than the minimum span which is allowed for the analog input card. For DIRECT circuit input, span is the difference between Range High and Range Low. For INDIRECT circuit input, span is the difference between Circuit High and Circuit Low.

Response: The minimum span requirements for each type of analog input card are listed in the Ranges/Accuracy Table in Section 2 of this manual. Correct the range or circuit values and re-save this point.

INVALID LIMIT
The low limit value is greater than the high limit value (reversed limits).

The low limit value is equal to the high limit value.

The user has assigned a limit value which is not consistent with the action of the specified function.

Response: Correct the limit value and re-save the point or feature.

INVALID SELECTION
A parameter selected by the user is in conflict with another parameter entered for this point or feature.

Response: Enter a correct value for the parameter and re-save the point or feature.

INVALID SEQUENCE NUMBER
The Pseudo Point execution sequence number entered is not within the range zero through 60.

Response: Select an unused sequence number between 1 and 60 to activate the Pseudo Point, or enter zero to suspend execution of the Pseudo Point. Press **SAVE** to update the Recorder database.

LEFT SCALE VALUE INVALID
Analog Input programming. The value entered for Left Scale is illegal for the input type selected.

Response: Refer to the Ranges/Accuracy Table in Section 2 of this manual for specific limits for each input type.

MATH OP ARRAY FULL
The internal "math op array" of the Pseudo Point database is full.

Response: This array is used by all Pseudo Point Math equations. No additional math equations can be programmed unless existing math equations are removed.

NOT DEFINED
The requested point or feature has not been programmed.

Response: Reprogram or remove the current point or feature.

OPTION REQUIRES HARDWARE
The current point or feature is attempting to make an assignment to a non-existing hardware item. This error can occur when programming Pseudo Points, Alarm Levels, or Analog Outputs.

Response: If the selected output should be available with the current hardware configuration, verify that the hardware is working properly.

If the selected point is not available with the current hardware, select another output and re-save the point or feature.

PP CONSTANT ARRAY FULL
The internal "pp constant array" of the Pseudo Point database is full.

Response: This array contains all of the values that are entered as direct numeric values in both the Pseudo Point prepared functions and math equations. For example, the math equation (AI16 + PP12) / 3.1416 uses one entry in the "pp constant" array to store the value "3.1416". Most of the Pseudo Point prepared functions allow entry of direct numeric values.

NOTE: The Pseudo Point Low and High Limit values are NOT stored in the "pp constant array" and do not cause this error.

In order to program additional functions which use direct numeric values, the user must reduce the number of direct numeric values in existing functions. This reduction can be accomplished in one of two ways:

- Remove existing Pseudo Points which have been programmed using direct numeric values.
- Replace the direct numeric values (where allowable) with CN constants (Mathematical Constants, Section 6).

PP DISCRETE ARRAY FULL
The internal "discrete element array" of the Pseudo Point database is full.

Response: The following Pseudo Point prepared functions use this array: Logic AND, Logic OR, Logic XOR, Logic NOT, Rate of Change, Signal Selector, Totalization Hours, and Totalization Minutes.

No additional functions of the types listed above can be programmed unless existing functions of these types are removed.

PP PREV VALUE ARRAY FULL
The internal "previous value array" of the Pseudo Point database is full.

Response: The following Pseudo Point prepared functions use this array: Low Peak Pick, High Peak Pick, Rate of Change, Single Input Average, Multiple Input Average, Time Compare, Totalization Hours and Totalization Minutes.

No additional functions of the types listed above can be programmed unless existing functions of these types are removed.

PP VECTOR ARRAY FULL
The internal "vector array" of the Pseudo Point database is full.

Response: This array is used by the Math equations and all Pseudo Point prepared functions except Logic AND, Logic OR, Logic XOR, and Logic NOT.

No additional functions which use this array can be programmed unless existing functions are removed.

PREVIOUSLY ASSIGNED
The specified output device (e.g., a DO relay) has already been assigned as the output of another function.

Response: Select an unused output device, or reassign the output device of the conflicting function.

RECORDER IS NOT IN THE PROGRAM MODE
The user attempted to SAVE a point or feature, but the recorder was not in the Program Mode.

Response: Use the **ESCAPE** key to return to the highest level programing menu, and select the Program Mode.

REQUESTED ELEMENT NOT AVAILABLE
The requested point is not available with the current recorder hardware configuration.

Response: If the selected point should be available with the current hardware configuration, verify that the hardware is working properly,

If the selected point is not available with the current hardware, select a valid point and re-save the point or feature.

RIGHT SCALE VALUE INVALID
Analog Input programming. The value entered for Right Scale is illegal for the input type selected.

Response: Refer to the Ranges/Accuracy Table in Section 2 of this manual for specific limits for each input type.

SYNTAX ERROR
There is an error in the algebraic expression entered as a Pseudo Point Math equation.

Response: Check the math expression for:
- missing or unneeded parentheses
- missing or unneeded operators (+, -, *, /)
- missing or unneeded variables (AI, AO, PP, CN, or number)
- missing or unneeded functions (ABS, LN, LOG, etc.,)

Correct the math equation and re-save.

TOO MANY PARENS
There are more than 10 sets of parentheses in the Pseudo Point Math equation.

Response: Reduce the number of parentheses in the math expression. This can be accomplished by separating the expression into two or more Pseudo Points, and then combining the results of these "intermediate" calculations.

VALUE OUTSIDE OF LIMITS
Value entered is not within acceptable limits for the point or feature being programmed.

Response: Correct the value and re-save the point or feature.

VARIABLE MISSING
A required piece of data was not entered by the user.

Response: Enter the required information and re-save the point or feature.

VARIABLE USAGE IS ILLEGAL
The parameter entered by the user is not valid for the field in which it was entered. This error may also occur because a required piece of data was not entered by the user.

Response: Enter a valid parameter in the highlighted field and re-save the point or feature,

WARNING - LIMITS ARE NOT USED
The programmer has entered low and high limits for a Pseudo Point function which has no analog output value (Logic AND, for example).

Response: The message will appear when the **SAVE** key is pressed; press the **ENTER** key to complete the SAVE process.

RECORDER INTERNAL PROGRAMMING ERRORS

If one of the errors listed below is encountered, repeat the action which caused the error message to appear (for example, press the **SAVE** key again, etc.). If the error continues to occur, delete the point or feature (using the **REMOVE** key), re-enter the programming information, and press the **SAVE** key to update the database. If problems persist, refer to Service Manual #277801 for corrective action.

Remember also that if an optional Expansion Unit is installed, it must be powered ON before the Recorder is powered ON, or errors will result.

BYTE COUNT INVALID
Recorder internal error. The recorder encountered a message whose byte count is incorrect.

CONFIG MESSAGE STRUCTURE ERROR
Recorder internal error. The Recorder encountered a message whose format is incorrect.

DATA FIELD LENGTH ERROR
Recorder internal error. The Recorder encountered a message whose data field length is incorrect.

FLOATING PT DATA FORMAT
Recorder internal error. The software encountered an illegal floating point number in the database.

INVALID ADDRESS BYTE
Recorder internal error. The Recorder encountered a message which references data outside the scope of the recorder database.

INVALID COLOR
Recorder internal error. The Recorder encountered a message which contains an invalid color code.

INVALID CONFIG MODE CODE
Recorder internal message error.

INVALID DO ASSIGNMENT
Recorder internal error. An attempt was made to assign an unrecognized variable to a digital output.

INVALID FUNCTION CODE
Recorder internal error. The Recorder was requested to configure a Pseudo Point function with an illegal function code.

INVALID PP NUMBER
Recorder internal error. The Recorder was requested to configure a Pseudo Point whose number was greater than 60.

NUMBER OF INPUTS IS INVALID
Recorder internal error. A Pseudo Point programming message contained too many arguments.

RANGE TYPE INVALID
Analog Input programming internal error. An unrecognized input type code was received during a SAVE.

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